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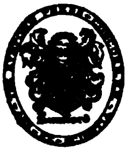

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 121. MARCH, 1918.

NATIONAL STATISTICS IN WAR AND PEACE.[*]

BY ALLYN A. YOUNG.

Our national participation in the war has brought with it an enormous demand for prompt and exact statistical information. Such a demand is, of course, an inevitable accompaniment of a war waged under modern conditions. War has come to be a conflict of directed masses,—of aggregates. Men, money, munitions, food, railways, shipping, raw materials, and manufactured products in great variety are impressed into the service of the nation. The problems of the effective control and use for war purposes of these varied national resources is intimately dependent upon a knowledge of their quantities, that is, upon statistics. Like chemistry, physics, and the applied sciences, statistical knowledge and the statistical method have come to be important tools of modern warfare. Just as this war is our largest national undertaking, so its statistical demands constitute, in the aggregate, the largest statistical problem with which we have had to deal.

The statistical activities of the federal government in times of peace cover in the main only those phases of national life which are deemed to be of public and especially of political moment. Our census of population is taken primarily to afford a basis for congressional apportionment; our census of manufactures and our foreign trade statistics still bear the marks of tariff controversies, and our federal statistics of wages and prices may be traced back to the same origin. In other fields, as diverse as immigration and railway transportation, our federal statistics are at once a by-product of federal control and a guide in the exercise of that control. In the fields of federal finance, money, and banking, our statistics are largely administrative by-products. The statistical work of the Department of Agriculture is a recognition, inadequate as yet, of a public interest which is probably only in small part political, and so with the statistical work of the Geological Survey and the Bureau of Mines. The work of the Bureau of the Census in the field of vital statistics is the most noteworthy example of the recognition of a large social interest which is not primarily either economic or political.

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[*] Presidential Address at the seventy-ninth Annual Meeting of the American Statistical Association, Philadelphia, December 27, 1917.

Thus the federal government, in its statistical work, has touched the current of our national life at only relatively few points, and at some of these only intermittently. For the most this current flows on in its own channels, free from disturbance or questioning or measurement by the government. Except to the tax-gatherer, a large part of the productive and business activities of the country have not been deemed to be matters of public concern, even as group aggregates.

The changes brought by our entrance into the war have been profound. Other activities have had to be subordinated to the necessities of the efficient and successful conduct of the war. This subordination, we may well believe, is only imperfectly realized as yet. If the war continues it is certain that the field of activity over which the public interest will be deemed to extend must be much further widened.

Our national problem, in its essence, is that of directing our efforts and output into new channels, of focusing all of our national energies on the one supreme task before us. Individual desires and whims are no longer masters of our economic life. Instead of doing what it is most profitable to do, men are beginning to do, and to do willingly, what they are bidden to do.

This new ordering of life works through such diverse forms as the drafting of men, the commandeering of ships and workshops and supplies, the control of prices and output, the restriction of exports and imports, the supervision of the processes of market distribution, the regulation of consumption, the coördination and administration of transportation agencies, the solution of labor difficulties, the raising of vast sums of money through taxes and loans, and the creation of priority rights.

The successful execution of such a program calls for a degree of national self-knowledge far beyond anything that we might have imagined necessary or possible in the past. We have been suddenly thrust into a situation in which we find ourselves in urgent need of a complete inventory of our national assets and a complete record of our productive activities. In this need we find the explanation of that enormous demand for prompt and exact statistical information to which I have referred.

In this emergency we turned first to our existing stocks of statistical information and to the current statistical output of our government bureaus, and have realized, perhaps for the first time, how woefully incomplete and inadequate our federal statistics are. With our latest population figures seven years old, our latest statistics of manufacturing output three years old—and it is surprising to find how antiquated and how useless for present purposes this latest manufacturing census is—and with no information whatever respecting important fields of trade, we were in a state of statistical unpreparedness.

Under these conditions a war statistical service had to be improvised. With no centralizing and coördinating agency at work, the boards and commissions created to take charge of the various fields of war work have had to procure for themselves, as best they could, the statistical information needed for their purposes. In part, it is true, these inquiries have taken the form of assembling information furnished by other organizations, and more especially by the permanent statistical offices of the government. But there is scarcely a war board or commission in Washington that has not had to make independent statistical investigations of its own, involving the collection, tabulation, and analysis of necessary facts. In many instances this work has been of sufficient magnitude to lead to the organization of separate statistical bureaus or divisions within these war organizations. A few of these rival in the size of their staffs and of their statistical output the larger of the permanent statistical offices.

I shall not attempt to describe in any detail the work of these new statistical agencies. Hurriedly organized, confronted by really formidable tasks and by the necessity of getting quick results, it was inevitable there should have been much misdirected energy. In particular there has been, admittedly, much duplication of inquiries. Each war organization, needing information of a kind not immediately available, has very naturally proceeded to obtain it at first-hand by direct investigation and inquiry. Because there is a large measure of overlapping in the statistical needs of the different war organizations there has been some overlapping of inquiries. Business men and trade organizations have found themselves required to furnish information, essentially similar, but with just enough differences to require the work to be done over again, for two or more Washington offices. These wastes are now becoming smaller, as a result of increasing knowledge on the part of each war organization of the activities of others. A less excusable form of duplication has come from the neglect on the part of some of the new organizations to inform themselves fully respecting the work of the established statistical bureaus, or, at any rate, from their failure to make use of the material that these permanent bureaus might easily have furnished them.

As for the work of these permanent bureaus, out of my own experience in the work of one of the war organizations, I can vouch for their unfailing attitude of helpful and generous coöperation. Certain of them, in fact, have taken on heavy additional burdens in this way. Thus one may cite the more adequate and more promptly published statistics that are now available for the production of minerals and metals, and the prompter tabulation of foreign trade statistics. These are merely examples, for there is hardly a statistical bureau in Washington that has not been called upon for some new or increased service. It must nevertheless be said that some of these bureaus have not risen to the full recognition of their opportunities. With so much that needs to be done, and so much that is being badly done by others by reason of insufficient experience or inadequate equipment, some of our permanent bureaus are giving virtually all of their energies to routine work, much of which is of relatively little present importance, or are merely marking time.

What I have just said should not be taken as imputing any blame to the men who are immediately responsible for the policies of these bureaus. Most of them are handicapped by inadequate appropriations and find it difficult for that reason to arrange for any considerable increase in their functions. And in many instances the available appropriations are for specific purposes and cannot be transferred to new undertakings. Not only has it been easier to obtain funds for the new war offices than for the established organizations, but the new offices have been encumbered by fewer restrictions respecting the precise way in which they should use their funds. In this way they have virtually been compelled to do for themselves what might, in many cases, have been more economically and efficiently done by one or another of the permanent statistical bureaus. In statistical work, as in other fields of government activity, the new war organizations have been superadded to the preëxisting administrative machinery rather than merged with it,—a policy which has its disadvantages as well as its advantages.

Returning now to the topic of the work which has been done and which remains to be done by the different war statistical bureaus, it is to be observed that despite the differences in their tasks, a common thread of interest runs through their work. They are all concerned, fundamentally, with the general tasks which I have mentioned earlier in this discussion: the measurement of our national resources, whether in men, money, or goods; the determination of our actual and potential output of the immense variety of things that are important, directly and indirectly, in the conduct of the war; the gauging, so far as may be, of our own needs and those of our allies and of the other countries that have to be recognized as in some measure dependent upon us. The problems of raising and equipping a fighting force, of providing ships and munitions, of food and fuel control, of the regulation of exports and imports, of the organization of transportation, of industrial priority, of the adjustment of labor difficulties, of national economizing, and of war finance, are all inextricably interwoven. Back of all these special problems is the general problem of the relative urgency of different national needs,—the problem of priority in the widest sense. Here not only successful administration but even the right choice of policies depends upon full and accurate knowledge, and in particular upon statistical knowledge.

It is partly, perhaps, because this statistical problem is usually discussed in terms of its parts, rather than as a whole, that its enormous importance has not been fully realized. When compared with our aggregate annual expenditures for war purposes, our expenditures for statistical purposes are seen to be almost pitifully inadequate. It is easy to see the wastes and the duplications in such statistical work as has been done. It is harder, perhaps, to realize the indispensable character of most of this work. It is even harder to visualize the real advantages and economies that would result from the organization of statistical inquiries on a vastly greater scale than now obtains.

Many of the mistakes that have been made—and some of them have undoubtedly been very costly—have been due to the lack of full and exact statistical information. Our expenditures for statistical purposes are not a thousandth part of our aggregate war expenditures. It might easily be wise economy to increase them ten or twenty fold. This much at least is certain: in range, in completeness within the fields which they cover, and in accuracy, the statistics now available furnish a wholly inadequate basis for the most efficient conduct of the task in hand. Our statistical apparatus has not expanded in any such degree as the field of public interest has grown. Confronted as we are by the necessity of making the most effective disposition of our national energies, we have not attempted to secure anything like a complete and accurate statement of the forces at our disposal. In some special fields our knowledge may be fairly complete, but in other fields it is either incomplete or non-existent. Most of all we lack the materials for a picture of the whole economic situation, invaluable as it would be as an aid in the shaping of national policies.

To make the point clear, imagine, if you will, what might have been accomplished if, when we entered the war, or even when our participation in the war came to be a serious possibility, there had been created a central statistical commission, instructed to develop a scheme for a comprehensive war statistical service. In the light of the experience of the other belligerents—for there are few elements of novelty in our own war problems—the greater part of our statistical needs might have been foreseen. Plans for the utilization and extension of the work of existing statistical bureaus, as well as for the creation of new ones for special purposes, would very likely have been made. To begin with, there would have been a complete census of population, with inquiries respecting sex, age, marital condition, citizenship, nationality, occupation, and income. The schedule would have been simple and the tabulations would have been merely those which threw direct light upon the problems in hand. Among other things this would have afforded a definite basis for a genuinely selective draft and for the right construction of a war income tax. Then there should have been a general census of production, covering extractive as well as manufacturing industries, especially for the whole field of staple products, neglecting some of the customary inquiries, but putting special stress on such points as stocks and consumption of raw materials, stocks and output of finished products, capacity, existing contracts—foreign and domestic—and number of employees. Similar inquiries might advisably have been made in the field of market distribution, at least so far as the wholesale, jobbing, brokerage, commission, and storage trades are concerned.

In the second place, provision should have been made for keeping much of this information up to date, through some system of weekly or monthly reporting, thus doing for important fields of industry and trade what is already done for agriculture and mining. The population census, even, might well have been used as a starting point for continuous local population registers, under the charge of the police or of local registration officials. In all of this work it would be sufficient if the general tabulations showed classes only, but information respecting individuals and firms ought to be available, by means of proper formalities, to the appropriate branches of the war administration.

This may seem to be an ambitious statistical program, but, in view of the unprecedented magnitude of the interests involved, it is perhaps unduly modest. Certainly it would have to be supplemented, in any adequate scheme, by provisions for a more elaborate centralization of statistics of railway operations and of the general movement of goods, for very much more detailed statistics of foreign trade than we now have, for more comprehensive official records of wages and prices, and for the compilation of all available statistics bearing upon economic conditions in other countries. I have left out of account the enormous mass of information that has to be gathered with reference to individual persons and firms and transactions, rather than to groups or aggregates, as primarily non-statistical in character. I have also omitted reference to the use of statistics in purely military operations, as a subject apart. It may be worth noting, however, that Napoleon put as much emphasis upon the value of complete statistics as a basis for military strategy as he did upon their use in the administration of civil affairs.[1]

Under such a scheme of organization as I have in mind the central statistical commission would have other functions than that of planning and apportioning the work to be done. It would remain as a centralizing and coördinating body, a clearing house for the national war statistical service. As new statistical demands arose they would be referred by it to the bureaus best qualified to secure the desired information. It would confer with the organizations asking for statistical service and with the bureaus furnishing this service respecting such practical matters as the best construction of schedules and the best tabulation of returns. Upon it would devolve the duty of making synthetic statistical studies of the whole national situation, the importance of which I shall try to indicate later.

I hope that I shall not be interpreted as meaning that no separate war statistical organizations should have been created, that all of the work should be done by established bureaus under the general direction of the suggested central commission.

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[1] Cf. A. de Foville, *Napoléon Statisticien*, in Journal de la Société de Statistique de Paris, December, 1911.

This would be manifestly undesirable and impossible. Some war organizations need statistical divisions for compiling and tabulating the records of their own activities. Some of them need special statistical inquiries or special statistical information that is of importance and interest only to themselves. In many instances, too, statistical material, wherever obtained, has to be combined and organized so as to meet the special needs of a particular organization.

The purpose of the suggested central commission would be, not to displace, but to coördinate and especially to supplement such statistical work as would naturally and necessarily be done if no such commission existed. Nor is the matter of economy through avoidance of duplication the most important factor. The inevitable duplication of work on the part of bureaus that are concerned primarily with their own particular problems is a matter of relatively small moment compared to the fact that no number, no matter how large, of isolated bureaus will adequately cover the whole field of necessary statistical information, so far as that field is one in which their interests are common. Each separate organization may cover the field in which its own interests are special, but this is no guarantee that it will be able to find anywhere or to provide for itself such fundamental statistics as are of common interest to itself and to other organizations.

The difficulties under which war statistical work has been carried on in Washington have come very largely from the absence of any organization with power to formulate the statistical problem as a whole. But apart from the particular advantages which the existence of this fundamental general statistical information would give to the separate branches of the war administration, there is the yet larger gain that would come from a comprehensive view of our national assets, and more especially of our annual national product. This kind of view is essential to the wisest national strategy, to the most effective use of our available powers. Only in this way can we find the materials for an estimate of our possible national savings,—not in terms of money, but of labor and resources and goods. Only in this can we gauge the maximum amount that the government may wisely spend for war purposes as indicated by the part of the national product and of the national productive forces that it can divert to its own uses. Such a statistical survey would indicate not only the foods, but also the raw materials, finished products, and classes of productive agents of which the supply is short as well as those of which there is a surplus. It would suggest, at least, where national waste exists. In short it would point the way, as I have already suggested, to the most effective marshalling and redistributing of all of our national energies.

To summarize: Our governmental statistical work has been largely concerned with such affairs as have happened to be matters of public or political concern. War not only enlarges the field of public interest, but it also creates a new set of values. These new values are not the outcome of the "normal forces of supply and demand," but are, or should be, the expression of conscious decision respecting the relative worth of different things and different activities for the dominant national purposes. These values can be effectively recognized and expressed in action only on the basis of a far more comprehensive mass of statistical information than has been available or is likely soon to be available. A practicable if not the only method of planning for and obtaining these statistics on an adequate scale is through the agency of a central statistical commission. The cost, however great, would be small as compared merely with the magnitude of the economic problems dependent for a right solution upon the knowledge such statistics would give, and wholly negligible in view of the larger interests involved.

What light does this review of the problem of statistical organization in war time throw upon the problem of statistical organization in time of peace?

It is not to be presumed that after peace is to be concluded we shall continue to want precisely the sorts of statistics that are now needed, that the field of public interest will be wholly unchanged. Nor is it to be presumed that we will be interested, as a nation, in just the things that were deemed most important before the war. The boundaries of the field of public interest will be narrower, undoubtedly, than they now are, but they will not be just what have been in the past. The lapse back from a thoroughly awakened national consciousness will not be complete. However large the measure of freedom restored to individual enterprise and to the individual conduct of life, we shall realize, as we have not in the past, the possibilities of doing things on a national scale, of rationally adapting the mechanism of national life to fit national ends. And there will be new national interests springing from our new participation in world affairs. There will be, in short, new fields of statistical inquiry.

It is possible that there will not be a ready and general acceptance of a premise implicit in what I have said: namely, that the organization of national statistics should, in fact, correspond in scope to the field of public interest. Is no weight to be given, it may be asked, to purely dispassionate and scientific interests? I confess to being somewhat skeptical with respect to the reality of a what is sometimes appropriately called "idle scientific curiosity." There is an interest in technique and there is an interest in problems, and may it not be that our "idle scientific curiosity" is merely a name for an interest in technique strong enough to make the choice of problem a matter of indifference. But without venturing further on disputed and dangerous ground one may safely observe that the function of a national statistical service is primarily that of securing and purveying statistical information; that is, in a large sense, of answering questions and of providing the material for the solution of problems. As statisticians I fear that we have sometimes permitted our interest in technique to blind us to the social importance of the right choice of the problems to be covered in our federal statistical service. There is much satisfaction to be derived from doing our best with bad statistical material, from replacing the missing facts by careful inference and shrewd conjecture. One can even sympathize with the scholar who complained that the modern wealth of printed bibliographies had destroyed scholarship. But as a guide to the choice and administration of national policy, verifiable facts are infinitely better than estimate and conjecture. If statistics is not to be merely an occult science, statisticians must interest themselves in enlarging the scope of their sources of information and particularly in what we may describe as the national choice of statistical problems.

Although before the war our national statistical activities could be explained in terms of past and present phases of public interest, it can not be said that all important phases of public interest were adequately represented. Even then, I think we shall all admit, our national statistical service had not kept pace with the fast-flowing current of economic and social change and with the accompanying development of new national interests. And with yet more profound changes impending in the near future, some form of method of statistical reorganization and adjustment will be urgently needed. This is because, in general terms, the formulation and administration of wise national policies must depend upon the national self-knowledge that only statistical information, gathered on a much larger scale than we have been accustomed to think possible, can give. Nor must the importance of an elastic and comprehensive scheme of statistical organization as an element in preparedness for war be forgotten.

A committee of this Association, coöperating with committees of other associations, has been studying the problem of the organization of statistical work in Washington. I am informed that it has given favorable consideration to proposals looking toward the creation of a central statistical commission. It is to be hoped that its efforts will help to secure tangible progress toward that end. But the functions of such a commission ought to include more than merely introducing some measure of coördination into the work of the existing Washington offices. It should be empowered to make recommendations to Congress for the inauguration of new statistical activities, utilizing either established offices or new ones, according to the circumstances of the particular case. It should control some discretionary funds, to be used in special inquiries made by its own staff or, more frequently, by one or more of the established statistical bureaus. Its fundamental interest should be less in the statistical work that is being done than in the work that is not being done. It should try to eliminate some of the statistical dead wood that now cumbers the reports of many of the Washington bureaus. It should not refrain, even, from attempting to introduce an element of national prophecy as well as of national history into our statistics.

If the statistical problems brought sharply into the foreground by the war hold any lesson that has a significance for times of peace, it is that we have not yet begun to realise the possibilities of federal statistics as a general scheme of national accountancy, or the responsibilities which the future holds for the statistician.

STATISTICAL UNITS AS STANDARDS.*

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I. INTRODUCTION.

The requirement that statistics shall be comparable and the employment of statistical methods scientific is no less important, although it is undoubtedly more urgent, in times of war than of peace. We may hope for an end to war but we cannot expect the demands of statistical usage to be any less exacting. Never before has there been the same need as at present for an evaluation of accepted institutions, beliefs and methods, and for an appraisal of the rôle which statistical science is to play in the solution of world problems. Approximations, loose thinking, false judgments, crude comparisons, the mistaking of cause for effect, etc., because of ignorance, prejudice or a wilful desire to deceive, seem forever to be condemned in the searching criticism of realities which has come to us with the war.

Few fields of public or private activity seem to have escaped the demand for the creation of new standards. In the so-called scientific world, the slow processes of adjustment to new and changing conditions seem recently to have been greatly accelerated. In the business world where standards of measurements, uses, activities, etc., have not already been fixed and installed, either competition or state regulation is forcing their adoption. The scientific approach to economic and social problems seems to have caught public attention. Accounting has had its meteoric rise during the last decade and its cost aspects are rapidly coming into their own. The aim is clearly the introduction of scientific method, the appraisal of differences and similarities, the determination of cause and effect, all with the purpose of adjusting the processes of private and public business to the particular demands and needs of time and place.

The development of statistical methods in the interpretation of biological phenomena has been rapid. In the fields of business and social science, however, the growth has been slower, and of a more uncertain and unscientific type. Only recently has the popular assumption been in part dispelled that by "statistics" one can "prove anything." Even now the position of statistical methods is not secure nor are the uses to which statistics are put above serious criticism outside the laboratories and research fields of statistical students, the statistical departments of some of the more advanced government bureaus, and the more progressive private businesses. Statistical surveys and even statistical departments, in private and public business, are common, but that statistics are more than records of past activities,—collected not because of their relationship to future policy but rather because they are "comparable" with those already at hand—and that they may be made to supplement accounting in the formulation of rules and principles for future guidance, unfortunately have not become generally felt. Their present position is similar to that occupied by accounting ten years ago. People are not completely nor universally converted to the wisdom of their use, nor are they fully cognizant of the extent of their application.

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*Paper read at the seventy-ninth Annual Meeting of The American Statistical Association.

The prejudice against both statistics and statistical methods, in part at least, is due to the following tendencies:

(1) To accept without serious question a plausible description of a given condition or state of affairs. *Ipse dixit* is often regarded as sufficient proof. The mere fact of statistics appearing in print, and particularly of their being in tabulated or graphic form—the finality of a statistical table or graph is often magical—is frequently sufficient to insure their value and to guarantee their application.

(2) To employ statistical data without knowledge of, or regard for the units of measurements in which they are expressed, or their comparability or representativeness, and to draw conclusions from them which they were never intended to support.

(3) To disregard detail, or to regard it as "detail" which somehow will take care of itself and needs no especial attention, to ignore statistical cautions respecting the collection of

data or the use of those already collected, to speak in terms of statistical abbreviations, averages of all types, to employ totals as if they were always more sacred and inviolate than the items which go to make them up, and to piece together statistical fragments, gleaned from different sources and compiled under widely different circumstances, into a beautiful mosaic which thoroughly proves or disproves a contention already held.

(4) To fail to formulate the purposes of statistical studies, to outline appropriate methods in order to serve the ends desired, to define with precision the units employed in the measurements, and rigidly to limit the field to be covered.

Statistics do not answer questions nor support conclusions independently of those who manipulate them. Judgment, candor, and integrity in their use are necessary at every step. The scientific development of statistical methods depends not only upon these but also upon a full realization of the meaning and function of units of measurements. It is statistical units as standards with which I shall deal in this brief paper.

II. UNITS AND STATISTICAL METHODS.

The statistical approach is numerical. Things, attributes, and conditions are counted, divided, subdivided, totalled and combined. Statistics are in large measure synthetic. They deal with aggregates, rather than single instances or rare occurrences. These, however, relate to units of measurements characteristic of things or conditions studied and apply to definite uses. It is not 1,000 as an abstract unit of frequency which is considered, but 1,000 farms, industrial establishments, loans, mortgages, etc. Numbers as abstract units may be combined, separated and divided because they are homogeneous, the more or less merely indicating presence or absence of a condition represented abstractly. But this is not true of units of measurements dealt with in statistics. The physical measurements of the unit "ton-mile," for instance, remain constant; but the qualities of the unit vary with each purpose for which it is used. A ton is invariably a ton and a mile a mile, but all tons, except as to weight, are not the same, nor are all miles, except as to length, equivalent. The problem of enumeration is not so much that of counting units describing different degrees of intensity, abundance or absence of the same thing, as it is of counting different things which have been given the same general name. Things which are equal to each other in name are often not so in use. Standardization implies homogeneity; it suggests conformity and suitability to conditions determined in the light of particular application. The meaning of a statistical unit is a function of the use to which it is put. An illustration will give point to this contention.

It is desired to determine the industrial accident rate in a given industry as a basis for fixing a scale of compensation. What is an accident? The reason for compensation is the consequences of personal injury and it is the character of the injury which serves as a basis for enumeration. All injuries involving a loss of any time howsoever slight might be thought worthy of inclusion. But since compensation is the occasion for the determination of the number, only those injuries should be included which cause an *appreciable* loss of time. What is an appreciable loss of time? To an individual who experienced the loss, it might be any time, howsoever slight. To the employer, however, who advances the compensation, and to the public who finally bears it, a period of one or two weeks might be thought to be the minimum compensable period. But many trifling accidents may occasion a far greater loss of time than a single or a few serious ones. There would be no hesitancy about counting the serious, yet there might be respecting the minor ones. But it is precisely the latter which frequently can most easily be prevented, and about which information may be desired, since precautionary measures involving little added cost to the employer, increased efficiency to the employee, and the gradual elimination of the occasion for compensation, may be taken for their eradication.

Moreover, only industrial accidents are to be compensated. Self-inflicted injuries as well as those occurring to workmen while not engaged in industrial operations, and when work done is not a proximate cause of injury, should be eliminated, when accidents are enumerated for this purpose. Moreover, is disease contracted directly as a result of the conditions of industry an accident? Surely it is an "injury," and if injury is the basis of compensation, ought not disease of this type to be counted in determining upon a reasonable basis? If disease contracted directly as a condition of employment is counted as an industrial injury (not "accidental," but characteristic or regular), how should instances involving impairment of health, mental or physical ability, be considered? How long a period must elapse before a condition, the result of employment, ceases to be checked against such employment? What is an industrial accident for compensation purposes?

On the other hand, if the purpose of enumerating industrial accidents were to measure the amount of time lost through mental or physical injury, obviously, all accidents and all diseases directly attributable to industry should be included. If the purpose were solely to secure information as a basis for removing the conditions causing accidents, or for assigning responsibility for them as between employer and employee, machine and injured person, those which were trivial, from the point of view of the individual, would take equal rank with those denominated severe. What is an industrial accident?

To formulate the purposes for which statistics are to be collected and used is the first step in statistical analysis; rigidly and unmistakably to define the units of measurements in which aggregates are expressed and to adhere to them throughout the process, is the second. The latter is governed by the former, as the former is determined by the latter. The two are reciprocal. Statistical units cannot be defined outside of the purposes of their employment, nor the purposes fully realized without the use of definite and standardized units of measurements.

The foregoing discussion will serve to make clear the distinction between the use of mass or frequency concepts in pure mathematical calculations and the use of the same concepts when associated with statistical units. Statistics is more than arithmetic. Numerical considerations and preponderance of evidence are the bases for statistical conclusions, but to arrive at them more than numerical computations are involved. It is concerned with the processes and methods of formulating and testing conclusions from premises resting upon numerical bases.

Leaving this more general discussion of the relationship of statistical units to the purposes for which they are used, certain types of units may be distinguished, and some of their peculiarities noted.

III. TYPES OF STATISTICAL UNITS OF MEASUREMENTS.

Distinction is drawn between *units of enumeration and estimamation* and *units of analysis and synthesis*. The first are those by means of which statistics are collected; the second, those by means of which statistics are interpreted. The former are related more to statistics as numerical facts; the latter, more to statistics as methods in the use of these facts.

1. *Units of Enumeration and Estimation.*

Units of enumeration and estimation may conveniently be divided into two classes, *simple* and *composite*. By simple units are meant those in which one determining consideration is prescribed. Most statistics of enumeration employ simple units, as, for instance, where persons, animals, acres, etc., are counted or estimated. In units of this type the conflict between identity and use is reduced to a minimum. They are simple and this fact normally guarantees against the presence of as great a degree of error as is associated with units which are composite in character. The unit "farm," for instance, for a given purpose, might be easily defined and the statistics of "farms" readily understood. When, however, the limiting word "improved" is added, both the scope of the unit and its application are noticeably restricted. The additional element is as subject to error as is the root portion of the combined unit. Crops in bushels or in acreage may be readily determined; to establish the "normality" of these crops, however, raises other problems and calls for superior statistical organization and for a much greater exercise of judgment. New conditions enter, occasions for error and bias crowd in, and it is these to which attention is drawn in distinguishing between *simple* and *composite* units.

Moreover, the addition of a limiting word to a simple unit may change the meaning which the root carries when used alone. For instance, the unit "room," in a survey conducted solely to determine the size of rooms in tenement buildings would be defined in such a way as to call for the listing of any portion of a house habitually used as a place of abode set off by walls with exits either closed or capable of being closed. To add to this unit the word "sleeping," suggests so many considerations respecting light, ventilation, size in respect to number of occupants, and time of occupancy, etc., as materially to alter the meaning attached to the unit when the counting was undertaken to determine size, but not size in connection with use.

The point which it is sought to emphasize is the fact that the identity of a statistical unit is a function of its use. For simple units, identity is established by general criteria; for composite units, by particular criteria. The more complex a unit becomes, the narrower is its application and the greater the necessity that its parts be standardized. Crude units may suffice for general impressions, but standardized measures are necessary for discriminating analysis. This is particularly true in cost accounting. Cost units must be reduced to their simplest and most elementary form. If composite or compound units are used, comparisons are likely to be misleading and their significance indeterminate. This fact is no less true in the use of statistical than in cost data.

2. *Units of Analysis and Synthesis.*

Both simple and composite units become *units of analysis and synthesis* when comparison or the establishment of relations follows from their use. Before classifying and discussing these, brief attention should be given to comparison and to what it implies statistically.

Comparison must be made between things possessing common qualities. These may be of time, of place, or of condition. For instance, the accident rate in a given industry may be compared before and after the installation of safety devices. Comparison may extend to two industries operating at different places or under different conditions, the purpose being merely to record a quantitative difference. But comparison is rarely made for this alone. Generally, a more or less definite purpose of establishing causal connection lies in the background. A specific inquiry is to determine whether phenomena stand in the relation of cause and effect, or whether they are the result of a common cause.

How nearly economic and business phenomena remain homogeneous for any appreciable period, even in an approximate sense, is always problematical. The forces affecting them are always in a state of flux governed as they are by population composition, state of trade, distribution of wealth, custom, fad, fashion, prejudice, etc. The whole range of human reaction is exhibited in more or less degree. Statistics under such circumstances often reveal a partial story, are not comparable from time to time and from place to place, and taken alone constitute a weak and uncertain base upon which to build a cause-and-effect structure.

Since comparison involves the pairing of things or events which are not identical in all particulars, a study of cause and effect, whether of coincidence or sequence, becomes largely a study of association. Causes never operate under exactly the same circumstances. Oneness of effect is only apparent, variation being evident the moment that the scale of measurement is reduced. Simply to assume the proviso "other things being equal" is not fully to atone for the sins committed in statistical comparisons. The "other things" are rarely if ever equal in actual life. Neither economic nor business phenomena go on indefinitely repeating themselves in one unending round of sameness. To expect that an absolute cause will always result in an absolute effect or that the "other things" will automatically take care of themselves is futile.

If comparison of economic phenomena is difficult, and the assignment of cause and effect rarely if ever absolute, the statistical units of measurements, by means of which comparisons are made, must be standardized according to use. Statistical comparisons involve the use of averages, of coefficients or ratios, in which enumerated or estimated numerators are related to enumerated or estimated denominators. To assign meaning to these without taking the trouble to determine the conditions which produce them or their suitability to the cases in point is as wrong statistically as it is logically to draw a false analogy. To do the first is to ignore the existence of determining circumstances; to do the latter to ignore their application.

The use of averages and coefficients as means of comparison suggests the formation of a judgment or a conclusion following from a full consideration of detail which they replace. Both represent the culmination of a process of thought and when removed from the steps required for their determination are likely to be assigned new meanings and used for purposes foreign to those for which they were designed. Neither should be regarded as a "secret something which determines events." They are simply statistical abbreviations into which are crystallized relations arrived at by logical processes of thought. Chronologically, they come late in the process of analysis.

Coefficients may be classified from two points of view; first, as *units of interpretation* and second, as *units of presentation*. Respecting the first: three subclasses, or more properly, three aspects may be distinguished, viz., those of condition, of time, and of place. The characteristic features of each subclass and the reasons for differentiating the concept in this manner may best be shown by means of illustrations.

(1) *Units of Interpretation*. By the use of clearly defined simple units of measurements, suppose the exact number of deaths from infantile paralysis, occurring in a given year, have been determined for a given district. The population of the same district has also been correctly enumerated or otherwise determined. The problem is to express the deaths from this cause in the form of a coefficient—to relate them to population. Obviously, the total population is too broad a base, since the particular cause of death is common to only a restricted group of the total. Conditions affecting both numerator and denominator must be made homogeneous. Similarly, industrial accident rates are of little comparative worth unless both frequency and severity are related to a standardized occupational exposure. If cost coefficients, in the business world, are to be significant, comparisons between stock turnovers, for instance, must be made only when classified sales at cost or selling price are related to classified stock reduced to corresponding bases. Likewise, labor turnover becomes a significant coefficient only when a unit of labor displacement is

related to a corresponding unit of labor force. Comparisons may be general only when the conditions upon which they rest have become standardized.

The distinction which is being emphasized is between crude and corrected coefficients. Crude rates are never to be preferred when corrected ones are available. Correction consists in more accurately defining, measuring and enumerating units and in referring phenomena rigidly to the conditions producing them. Where this is not done, the amount of error involved in comparisons is almost never known, and provision for it seldom possible.

Time and place are also factors of importance in the use of coefficients. A comparison of the death rates from malaria for the South and North is of little real value. There is little, if any, significance in a comparison of the number of miles of steam railroads per capita or per one hundred square miles of territory for New Jersey and Nevada. Why? The answer is clear; because the conditions are so widely different; the same phenomena are related to conditions wholly dissimilar or in each case of local application. Similarly, comparisons of the ratios of the number of bank failures to bank liabilities for the period before state and national regulations were inaugurated with the present time; of per capita city expenditures or debt of the 70's or 80's with 1917, are to a large degree without meaning. In the first case, regulation has so changed the conditions under which banking is done that there is little in common between the earlier and later periods; in the second case, the respective domains of public and private initiative differ so radically that a consideration of the amount of expenditure divorced from the benefits accruing from it is without merit.

Too great care can not be taken to make comparisons legitimate. This is particularly true in the case of statistical comparisons, since they are numerical and seemingly exact. A statistical statement is often taken by the unwary and uninitiated, as sufficient proof of its absoluteness and finality, and is made to support predetermined conclusions or premises to which it has no relation. Too much faith is placed in the efficacy of statistics to "prove things." Reasoning from other angles is too frequently dispensed with—if not utterly ignored—on the part of the uninformed when "statistics" can be utilized, notwithstanding the fact that they may have no application, may be incomplete, unrepresentative, and questionable in origin, and that the problem can not be understood by an appeal to its numerical side. Loose reasoning and hasty judgments are even less defensible when statistics are appealed to to support a contention than when they are ignored, for the reason that they seem to carry a finality and to suggest a nicety of conclusion not generally associated with a less precise method of approach.

(2) *Units of Presentation.* Coefficients may also be regarded from the point of view of *units of presentation.* This thought suggests classification or the art of arranging data into groups according to their common characteristics. "Performed consciously or unconsciously, the act of classification is indispensable to and accompanies every scientific inference. A mind is orderly or slovenly, according as it does or does not habitually and accurately classify the facts with which it comes in contact. The success of an investigation, the worth of a conclusion, are in direct proportion to the fidelity to this principle and the exhaustiveness with which the process is carried out."*

Loose thinking, mistaken emphasis, and the assignment of cause for effect, or vice versa, result from a denial or a violation of this principle. This truth is involved in all that is suggested in the term "standardization," and applies no less to statistical science than it does to business and economic procedure. It is the principle of orderly arrangement, and to violate it is as indefensible when dealing with statistical facts as when formulating, for instance, systems of cost accounts. A cost system which failed to distinguish between overhead and material costs could no more be defended than a statistical summary which grouped together facts of different properties. Combinations must be made on bases that are common, and classification must follow lines that are significant.

It is indispensable, if statistics are to function, to adopt those units of presentation which give facts vitality. Statistics collected, classified and tabulated without a well-defined purpose are seldom of much value because of the lack of care in their preparation and because of the absence of a controlling purpose in their presentation. Too frequently the unit groups are so broad, purposeless and indefinite that whatever value the facts may have had as collected, is lost by the failure to correlate the method of presentation with the purpose or function which they are to play. Thus we have death rates tabulated by districts so large that correlation of deaths with their respective causes in detail is difficult if not impossible. From an administrative point of view, such statistics are frequently worthless. Similarly, density of population —a common coefficient—becomes meaningless when assigned to so large a population and so diverse conditions as those comprehended in an entire city. Density as a coefficient is significant only where over-crowding is a problem. Again, it is of limited significance to know that the great majority of wage earners in the United States receive less than, say, $1,200 a year. What is necessary to know is the distribution and wages of those below this limit. The wages of a non-homogeneous class expressed as a total or as an average are of little significance in throwing light on such problems as the distribution of wealth, the basis for arbitration of wage disputes, standards for minimum wages, etc. Units for expression are generally too broad; the facts are related to conditions which are not homogeneous. Statistics in this form become more an end than a means to an end, more a goal than a process.

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* Cramer, Frank, The Method of Darwin: A Study in Scientific Method, p. 88.

Too great an expense and insufficient time are the stock excuses given for failure to classify and present statistical facts in detail. The validity of these common excuses for inefficiency and statistical sinning is not always easy of determination, but it is clear that it is not money and time which constitute our gravest statistical needs, but coöperation, planning, correlation of activities, and above all an appreciation of the fact that statistics may serve not only as records of past achievement but far more significantly as guides for future activities. They find their chief justification in the manner in which they minister to our positive needs.

IV. CONCLUSION.

Our general conclusions respecting statistical units as standards both in definition and application may be summarized as follows: Units should be clearly and fully defined in the light of the uses which they are to serve, in keeping with the intelligence of those who are to use them, and in such form that overlapping conditions will be readily detected, misunderstanding difficult and employment specific. They should be rigidly referred to the conditions which produce them; should be homogeneous with respect to the purposes for which they are used, and employed with consistency and integrity. After all, in the development and use of statistical units as standards, as in all statistical processes, an appreciation of the meaning of scientific method and a willingness to be guided by its requirements are indispensable. If either is lacking, statistics and statistical methods are without a logical defense.

THE STATISTICAL WORK OF THE WAR TRADE BOARD.*

By W. M. Adriance, *Director, Bureau of Research, War Trade Board.*

As everyone knows, these are days of unexampled activity in all departments of the government at Washington. The tasks incident to the carrying on of the war have resulted in the creation of what are practically new departments, such as "The Council of National Defense," "The Shipping Board," the Fuel and Food Administrations and "The War Trade Board," and have so stimulated the activities of the regular departments that it would be hard to find the bureau or division which has not felt keenly the urge and drive of the new conditions.

All this is true of the various *statistical* bureaus of the government, as well as of those whose functions are administrative. One of the first needs to make itself felt after the outbreak of the war was the need for statistical information. In connection with the draft and the distribution of its quotas came the need for new estimates of population. The informational work of the Council of National Defense, in the shape of a preliminary inquiry into the country's industrial facilities available for war, had its beginnings months before this country actually entered the conflict. With war once declared, new demands arose for the information in the possession of the Federal Trade Commission. Each day has brought its realization of some new task to be performed and the new task has usually carried with it a new demand for statistical information upon which its performance must depend.

It goes almost without saying that the statistical information of which the various departments were already possessed took on a greatly enhanced value and the existing agencies for collecting this information felt the stimulus of this new demand. But with the creation of new departments and bureaus, and the quickened functioning of the old ones, new statistics have been called for and new statistical bureaus have been rapidly springing up to supply them. So far has this gone that it would probably be safe to allege that no one man in Washington knows of the existence even of all the statistical bureaus of the government, and if there *is* such a man today, his information is likely to be out of date tomorrow.

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War means, of course, an enormous expansion of the activities of the Department of War and the Department of the Navy. The raising and sending to France of a great army requires elaborate calculations as to what are called "Requirements of the Program." How many pairs of shoes will be required for our soldiers during the year and how will these requirements be distributed over the twelve months? When millions are being dealt with, this becomes a very elaborate and difficult calculation and it must have as its foundation certain assumptions, or, preferably, statistical information, as to how fast shoes have to be replaced under the conditions of modern warfare. Similar calculations have to be made for munitions, guns, explosives, clothing, transportation, food, etc., in an infinite variety of detail. With requirements known, the next query relates to the supply available to meet them. For government purchasing on a relatively small scale it is sufficient to get in touch with manufacturers by some such process as competitive bidding, supplemented perhaps by information as to the commitments of the individual firms, but for modern warfare a different process is necessary. We must know military requirements, both our own and those of our associates in the war. We must also know the civilian requirements, and over against this total we must set stocks on hand and future productive capacity. The latter may be partly judged, of course, by past production. If total supplies are inadequate it may be necessary to give preference to government needs through the process of commandeering and in many cases it may even be necessary to erect new plants to bring *supply* into relation with the abnormal *demand* of war conditions.

But in any event, statistics of stocks and of production are highly important. Speaking generally and allowing for certain recognized exceptions, we may say that at the outbreak of the war production statistics adequate for war purposes did not exist. The greatest activity has, therefore, been shown in getting them together. Our manufacturers have been bombarded, and are likely to continue to be bombarded, by questionnaires and by other requests for information emanating from various governmental organizations and only too frequently involving duplication of effort and an undue burden upon the people who furnish the information.

The primary function of the War Trade Board is the control of exports and imports. This simple statement, however, covers a wide range of activities and complex multiplicity of duties, calling for statistical data of many different kinds. This control of exports and imports is, of course, intended to be the sort of control which will add to our national efficiency in the conduct of the war. On the side of imports it becomes a question of what commodities produced in other countries are essential for our operations, and what are to be regarded as luxuries and for that or other reasons cut off as unessential. On the side of exports, it is important to see to it that valuable commodities shall not reach the enemy through contiguous neutrals or otherwise, that neutrals shall not receive exports from the United States which are vitally needed here, and that exports shall move to neutral countries where necessary as a means of obtaining imports in return.

In the carrying out of such a program, a great variety of statistical information must be at hand. The export and import figures of the United States, both before the war and for the three years that the war has been going on, afford, of course, absolutely essential information. But this is far from being the whole story. The normal trade and the war trade of other countries also need to be very carefully and analytically studied. This necessity is a matter of common knowledge in the case of the neutrals of Europe, because of the fear that these countries were serving as a channel through which the Allies might actually supply their enemies with the means of making war.

For many months newspaper and magazine discussion of the problem of the northern neutrals has teemed with statistics and pseudo-statistics of their trade activity. In many cases these statistics have been either absolutely incorrect, or, at the best, extremely misleading. It was alleged, for example, in a periodical of wide circulation, that last year seventy-five million tons of pig iron were shipped from Sweden to Germany. Now the fact is that Sweden sends *iron ore* rather than *pig iron* to Germany. Her total production of iron ore has never exceeded seven or eight million tons and her exports to Germany have never gone above six million tons. The importation of this Swedish ore, which has a very high metal content, has been of enormous value to Germany, but it is a small amount relative to the alleged seventy-five million tons. The same writer states that in the first three months of 1917, Sweden imported from the United States 16,300,000 tons of pig iron. This is at the rate of nearly seventy million tons per year, which quantity actually exceeds our total production.

Such statements can only be explained on the supposition that *pounds* have been confused with *tons*, or a decimal point misplaced, or some similar gross error committed. Other statistics, correct in themselves, lend themselves to misinterpretation. For example, Swedish imports of grain from the United States increased very greatly after the war in Europe began. This has often been interpreted to mean that Germany was getting the grain. The truth was that Sweden's normal imports from Russia and Germany had been cut off and she had turned to America to make up the deficiency. In spite of our large exports of grain to Sweden in 1914 and 1915, it does not seem likely that the grain was going in any great amount to Germany. Sweden has given Germany very valuable economic assistance, but not to any extent through the import of American iron or the re-export of American grain.

American editors should guard themselves with great care against such errors and misinterpretations. Their evil is twofold; they create misapprehension in the minds of our people as to the relation of the neutrals to the war, and they stir up resentment in the countries concerned at such palpable misrepresentation.

The actual relationship of the European neutrals to the countries at war is a matter of very great import, and it has been made the subject of very careful statistical study by the War Trade Board.

These countries are asking the United States for various imports, particularly food. Exactly what we shall determine to let them have, and just what we shall get in return, are things which are yet to be announced, but they are matters which are being worked out by careful statistical investigation.

This study necessarily covers the field of production, consumption, and trade statistics of the countries concerned.

A second large field where the War Trade Board has a difficult task to perform is found in the Latin American countries. These countries need to be considered from two points of view; as sources of supplies vitally needed by the United States, and as consumers with claims upon us for our exported commodities. Certain things from Latin America we must have: prominent on the list being Chilean nitrates, Mexican oil, Cuban sugar, Brazilian manganese, and rubber and copper from various countries. Where exports are necessary as a means of getting these imports or as a means of paying for them, which is much the same thing, the problems of exports and imports are intimately related to each other. In some cases, however, the question of export allowances reduces to simple questions of need in the country concerned as against available surplus in the United States. In estimating the needs of the various countries, their production and trade statistics as well as our own statistics of exports to them and imports from them, have to be carefully studied.

The war, of course, has caused very great dislocations of trade, and these have to be taken account of as far as possible in calculating export allowances. It is not uncommon, these days, for the War Trade Board to receive urgent requests, particularly for food, from countries whose normal sources of supply have been dried up, and in some cases changes in regular trade channels have to be brought about by the control which the United States can exercise over its foreign trade. Such action is likely to be motivated by the necessity of conserving tonnage, as well as by domestic shortages in the United States. If certain countries of Latin America should be required, for example, to look to Argentina instead of to the United States for their supplies of wheat flour, the action will be grounded on considerations of both sorts, and obviously trade statistics and a study of tonnage and distances are the necessary foundations for a sound policy. Such questions, therefore, fall within the field of inquiry of our bureau.

This rationing of various countries is fraught with great import to the countries concerned, but our right to control our own trade is undisputed, and our decisions are likely to be accepted as dictated by war necessity.

When we come, however, to the question of apportioning export licenses among our own exporters, we have a problem of another sort. Here, too, the spirit of toleration at present exists. Export control is a new task, due to the war. It will take time to work out an equitable system. There is a general realization of this, but there is also a demand that some equitable system shall be worked out as speedily as possible. To be equitable, such a system should probably have a statistical basis of some sort. Plans are now being worked out for the establishment of a statistical control over the apportionment of exports among consignors, but it is a problem which will require a considerable amount of time for its complete solution. Meanwhile, the task is being performed as best it can by methods which will be discarded later on as mere makeshifts.

I have said already that those parts of our government which are charged with the actual making of war are interested in requirements, stocks on hand, and statistics of production. The War Trade Board is interested in these same things from another point of view. It is very much interested indeed in the question of exportable surplus. Now exportable surplus cannot be expressed in terms of a fixed formula. I can show this by an example The Bureau of Research carefully collected production, export and import figures for a certain cereal, the export of which last year was unusually large, and we reached the conclusion that this year's crop was large enough so that we could export as much as last year and still have more left for home consumption than in recent years, and this without allowing for any imports whatever. Imports in recent years have been large. We arrived, in other words, at a figure which we called "the exportable surplus." We then allotted a certain part of this amount to Latin America and determined the proportion which might go to a particular country. When this figure was presented to the Food Administration for approval, the verdict was rendered that the said country could have none of the said cereal. At first glance this might seem like the abandonment of a statistical basis for the calculation of export allowances. As a matter of fact it was not. Other crops, notably wheat, are short, and the action of the Food Administration meant simply that the other cereal must be more largely consumed than formerly, both by ourselves and by our European associates in the war, as a means of compensation for the shortage of wheat. It was a particular method of calculating the surplus available for export to Latin America, based upon the principle that the exportable surplus of one commodity is a partial function of the supply and demand statistics of another, and, it needs to be added that the policies of the Food Administration are based upon very full statistical information gathered by their own statistical bureau.

It is one of our tasks then to ascertain this rather elusive thing which is called "exportable surplus" and then to apportion the exportable surplus among the countries to which it is to go, and although exportable surplus does not lend itself to any one rigorous definition, yet stocks on hand and production statistics are of the essence of its calculation. Hence the interest of the War Trade Board in these statistics, an interest which overlaps and runs along with that of the War and Navy Departments, the Council of National Defense, and other departments.

The point that I am leading up to is this: the importance of coöperation between the various departments in the collection of statistics of stocks and of production.

The committees on Federal Statistics of the Economic Association, the Sociological Society and the Statistical Association, are, as you know, interested in the general problem of coördination and coöperation in the statistical work of the various departments. Particular aspects of this problem present themselves in the ordinary course of our work, and in a piecemeal fashion beginnings are being made towards its solution. For example; the Geological Survey had before the war established itself in the field of mineral statistics. Plans have recently been made between the Survey, Doctor Ayres' office (the Division of Statistics of the Council of National Defense), and our own, for the coöperative collection of statistics of non-ferrous metals. Perhaps I should say that Doctor Ayres' office initiated the plan and that we were very kindly included in the arrangement.

A great deal more work of this coöperative sort needs to be done. If there were in existence today a general coördinating statistical commission, such as is contemplated by the committees on Federal Statistics of the three associations, it would be of the very greatest service in the winning of the war. Without such a commission, coöperation, coördination, and the avoidance of duplication in war statistical work are, under the drive and stress of war conditions, very difficult matters to work out.

THE DEVELOPMENT OF MILITARY SANITARY STATISTICS.*

By Walter F. Willcox, *Professor of Economics and Statistics,*
Cornell University.

By military sanitary statistics is meant the sanitary statistics of military organizations or armies in time of peace or war. It deals with the statistics of sickness and wounds and of deaths resulting from sickness and wounds. It is thus a subdivision of morbidity and mortality statistics.

The study tries to throw light upon the results from various means of reducing morbidity and mortality. This is its main purpose, but it has also a minor purpose, that of showing how far, under present conditions, it is possible to study the morbidity and mortality among soldiers, an occupational class which is rigidly supervised and closely observed, and thus of showing how far it is now possible to study the morbidity and mortality of other occupational classes less open to careful observation.

Unlike the vital statistics of the civil population, these military statistics have not had a steady and regular development. Advances in this field have usually come fitfully and with long strides during or after important wars which have tested the statistical methods, perhaps thought satisfactory in time of peace, and revealed serious defects or weaknesses. It is even more true of them than of statistics in general that their development has resulted from the initiative and energy of a few individuals who often had to struggle against the inertia or even the active opposition of a rigid, inflexible system.

The nineteenth century has been called "the statistical century." At its threshold what statistical information there was regarding the life of states was treated as a state secret to be carefully kept from the public. Partly for lack of this information public opinion, the vital force and guiding principle of modern nations, was cramped in its development, and the guidance of the state was left in the hands of a small governing group or clique to whom alone these arcana were accessible. By the century's close, even the most autocratic or reactionary governments had begun to publish statistical information and had thereby prepared the soil for a vigorous growth of enlightened public opinion. With even greater truth the nineteenth century has been called "the century of democracy." The two currents of development have not merely run parallel, they have reinforced each other and in a sense are diverse aspects of a single series of changes.

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*Paper read at the seventy-ninth Annual Meeting of The American Statistical Association.

In no field has the transformation been more marked than in that of military statistics. When the United States secured its independence and for a number of years into the nineteenth century, no country in the world possessed trustworthy and detailed information about the health of its military and naval forces. What meager information we have regarding the medical history of the American Revolution is in a few references scattered through the works of Dr. Benjamin Rush, and that regarding the medical history of the war of 1812 is limited to Dr. James Mann's *Medical Sketches.* Soon after the close of the Napoleonic Wars, England began to record the medical experience of her army in reports of the medical transactions in the British army, a series established by Sir James McGrigor, the director general. In this, as in many other lines of statistical activity, the United States echoed speedily but feebly the movement started in the mother country. Quarterly medical reports of the cases of sickness and death in the American army began in 1819, three years after the English series started, and the system has been maintained with some modifications for almost a century. In both countries for years dust gathered on these annual reports, which were well nigh useless as guides to action for protecting the health of American or British soldiers. But with the great popularization of statistical researches on both sides of the Atlantic in the thirties of the last century, these long forgotten reports were disinterred and used. Here again we were followers of England, in which country the initiative was taken by an individual and followed by the government. A. M. Tulloch, then in the recruiting service, interested himself to discover whether a system of discharging every soldier after ten years of service would not reduce the heavy financial burden of the existing system. To get an answer, he needed to know the death rate in the army and found that a deputy inspector of military hospitals in Edinburgh, named Henry Marshall, had gathered much information on the subject. At the time when Tulloch published his results,[*] the Secretary of War, Earl Grey, was concerned about the heavy losses among British troops in the West Indies and his attention was drawn to Tulloch's conclusions. So the latter was asked to draw up, first for the secretary of war and later for Parliament, a statement about the mortality in the army prepared from the unpublished reports of the Medical Department and the War Office. Tulloch's first articles appeared in 1835, and three years later, perhaps as a result of his work, returns regarding the health of the British troops in the West Indies after 1817 were published, and in 1839 returns regarding the health of the British troops in the United Kingdom after 1830 first saw the light. The next year saw the first American publication in this field, a study of the sanitary conditions in the American army, 1819–39, the first twenty years of observation.[†] The author was a member of the United States army and prepared his monograph under the direction of the American surgeon-general.

In this field, as in many other lines of democratic development, Great Britain pointed the way, the United States followed next and on the Continent like changes were made later. Thus in Prussia annual returns began in 1820 and the first interpretation of these manuscript sources was made in 1843 by a private statist, but no official publications appeared until 1860; for the Austro-Hungarian army meager and insignificant data were given out for the years 1844–47; for France the army mortality figures of single scattered years were published as early as 1822, but no reports appeared on a common plan or for consecutive years.

Such was the situation when the Crimean War in Europe, the Civil War in America, and the first of a series of Inter-

[*] *United Service Journal*, XVII: 145–170 (January, 1835), "Observations on Military Pensions," and XVIII: 145–172 (May, 1835), "Mortality among Officers in the British Army."

[†] Samuel Forey, *Stat. Rep. on the Sickness and Mortality in the Army of the United States*, Washington; 1840.

national Statistical Congresses occurring at intervals through the third quarter of the last century coöperated to stimulate the recording of sickness and death in the armies of the world as the indispensable prerequisite of far-reaching and systematic efforts to safeguard the health of the soldiers. Probably no other period of equal length has seen so much progress in army sanitation as the decade which embraced the Crimean War and the American Civil War.

When the woeful lack of preparation for the wounded and the sick in the Crimea and Constantinople was made known to England, in October, 1854, soon after the battle of the Alma, it so happened by great good fortune that the two persons who could be of most help were intimate friends. One was Sidney Herbert, the secretary of war; the other, Florence Nightingale, who for years had yearned to become a nurse, had prepared herself for that work by study and practice in the best German and French institutions for training nurses and at the time was in charge of a sort of hospital in London. Something of a scandal was resulting from the letters of a responsible newspaper correspondent who described the wretched plight of the sick and wounded in the hospitals across the Bosporus from Constantinople and accused the British medical staff of gross neglect of duty. Secretary Herbert was technically only a financial official, but he went outside his proper field and decided that in the emergency he would break with army traditions and use women as nurses in military hospitals, as they had long been used in civilian hospitals. He wrote to Miss Nightingale, asking, "Would you listen to the request to go and superintend the whole thing?" On the day before he wrote to her, she had written to his wife a letter proposing to take charge of a small group of nurses to be sent to Turkey at private expense. She went and succeeded. The soldiers and the British public worshipped her and many even of the medical officers were won over to her support. The terrible mortality in the hospitals, a mortality of 60 per cent., or 600 per 1,000 cases, from disease alone during the first seven months of the Crimean campaign sank to about 22 per 1,000 cases, or about one twenty-seventh as great. These services and the popularity they brought her gave her the support she needed to start a movement for improving the sanitary organisation of the British army.

It might have been argued by defenders of the existing system that the conditions at Scutari and in the Crimea which had so stirred the British public were incident to war and no reflection on the system. To meet that objection, it was needful to know whether the conditions were continuing, whether the health of the British army at home and in time of peace was good or bad. After Miss Nightingale returned from her war work determined to fight for better treatment of her children, the soldiers, she met Dr. Farr, who pointed out to her the use of mortality figures in studying the healthfulness of various classes of civilians. Following this hint, she compared the death rate of British soldiers in barracks with that of men of corresponding age in the general population. It appeared that the soldiers, although supposed to be selected, healthy men, had twice the mortality of civilians of the same sex and age. This unimpeachable evidence was the strongest point in the argument by which Herbert and Miss Nightingale, working hand in hand, with almost daily consultations, through months of delay, triumphed over indolence and procrastination in high places and quiet but effective opposition among the medical men in the army. First, a Royal Commission was appointed with broad powers and Herbert was made its chairman. No one seemed to think then, as many would now, of making Miss Nightingale a member of the commission, although undeniably she knew more about the subject than any other person. The question of inviting her to appear as a witness was raised, but finally it was decided to ask her to submit written answers to a series of interrogatories. Her efforts to have Dr. Farr made a member were fruitless. The result was that Herbert and Miss Nightingale with help from Sutherland made a little inner circle which guided the commission throughout. Miss Nightingale's work was much like that of a competent commission secretary. As each branch of the inquiry was taken up she handed the chairman a memorandum about it, suggested the witnesses and often interviewed them before they testified. In some cases she prepared the briefs for cross-examination. The most striking feature of the report was the official promulgation of the figures she had prepared months before, showing that at home and in time of peace the mortality of the army was double that of the men of the same ages in the civil population.

Soldiers were recruited at about nineteen years of age. They came mainly from the ranks of agricultural laborers and town wage earners, were carefully inspected, and the weak ones were rejected. So they should have been especially healthy. Yet the death rate of non-commissioned officers and men per 1,000 mean strength was 33.0, while the death rate of males of the same ages in the general population was 9.2 and in the healthy districts was 7.7. Thus the death rate of soldiers in time of peace was three and one half times that of the male population of like age.

This comparison was open to criticism because a large portion of the army was serving in unhealthy tropical districts. To meet the objection, the returns from soldiers abroad were excluded. It then appeared that the death rate of the army at home in time of peace was 17.5 and that of the male population at army ages was 9.2 for England and 12.4 for Manchester, one of the unhealthiest cities in the realm. In other words, the death rate of soldiers in England in time of peace was 90 per cent. above that of the male population of like ages. But to make such comparisons fair, as the Report pointed out, the army death rate should be raised to allow both for those who did not apply or applied and were rejected because of feeble health and also for those who had served in the army, had been discharged in impaired health due to their service and afterwards died but whose deaths did not appear on the army record. The fairest comparison was thought to be that between the death rate of soldiers and the death rate of agricultural laborers of like ages, who were members of friendly societies and so received help in illness like that the soldier received from the government. A comparison with various occupational groups led to the conclusion that army life in England in time of peace was almost the unhealthiest occupation an Englishman could follow.

After clearly establishing this fact, the next step was to study the causes of the high mortality. Those suggested as worth studying were: (1) night duty; (2) lack of exercise; (3) bad habits; (4) crowded quarters and bad ventilation and sewerage. The first cause, although much emphasized by army medical men, was probably of little importance. The police had a more burdensome night duty but a death rate only half as great. Lack of exercise was probably more serious. Agricultural laborers were very long-lived and their main advantage lay in the amount and variety of exercise they took in the open air. Cavalrymen had a death rate much lower than that of infantrymen and the main difference in favor of the former was the greater amount of exercise they took in the open air and their heavier work in caring for their horses. The soldier suffers greatly from ennui, does little work, and has little to show for what he has done. Lack of the exercise connected with useful labor was, therefore, probably an important cause of a high death rate. Soldiers were probably not more intemperate than the classes from which they came, and there was little evidence that intemperance was a cause contributing to the high death rate of soldiers. Soldiers probably indulged in sexual excesses to a greater degree than civilians and venereal diseases among them were more widespread and harmful. But more important than any of these probably was the fourth cause of a high mortality, namely, crowded quarters and bad ventilation and sewerage. Pulmonary consumption was far more common and fatal in the army than in civil life.

In civil life insufficient clothing, unwholesome food, a sedentary occupation and vitiated air were causes predisposing to consumption. Only the last of these existed in the army. The only army in which the death rate did not decidedly exceed that of the civil population from which it was drawn was the native army in India. This was the only army not housed in barracks. Each sepoy received a small sum of money with which he housed himself. The minimum space specified for each soldier in barracks was 450 cubic feet (about 7 x 7 x 9) and in most cases this minimum was not provided. The distance between beds was even more important than the cubic space. This should have been but seldom was one foot. No regulation required the commanding officer to consult his medical officer before locating a camp, or to entrust such an officer with the task of cleaning and preparing a camp or a town to be occupied by large forces. Hence the attention given to medical opinion varied with the character and experience of the commander.

The next battle in the campaign was to secure action from the administration and through it from Parliament. This was even more difficult but was finally secured after a new cabinet had come in with Herbert as the secretary for war. Through long months he had been toiling night and day for the reform, and just as the cause was won his health broke and death took him. The result with Florence Nightingale was not very different; her work in the East during the war and her still more exacting work after her return, when for months, as she wrote in her notes, she stood at the altar of the murdered men, fighting their cause, left her broken in health for life, but glad of soul over the triumph of the reform.

One fundamental feature in the reorganization of the medical division of the British army was the adoption of the recommendations of a Commission on Army Medical Statistics, of which Herbert and Farr were members. Dr. Balfour, who had greatly aided in the reform campaign, was put at the head of the statistical work and his *First Annual Statistical Report on the Health of the Army*, printed in 1861, raised the medical statistics of the British army to the leading position in Europe.

Meantime Austria's war with Sardinia and France had resulted in suffering among the soldiers which appalled both sides. When their conditions were described by the eloquent pen of M. Dunant, a Swiss philanthropist who had gone to their relief, it aroused deep and widespread sympathy which, under the influence of another Swiss, M. Moynier, led to the Geneva Convention and the foundation of the Red Cross. M. Dunant, in a paper read at London, said: "It is to an English woman that all the honor of the Convention of Geneva is due. What inspired me to go to Italy during the war of 1859 was the work of Miss Florence Nightingale in the Crimea."*

When the American Civil War began in 1861, the experiences of the Crimean War and the danger of an equally unnecessary loss of life were in the minds of many enlightened American citizens. The volunteers were stationed first in state camps and not transferred to the federal government until they had been organized into complete regiments equipped for fighting. During this intervening period the men were undisciplined and developed or retained unsanitary habits. Their officers as a class were ignorant and incompetent, especially in dealing with questions of sanitation.

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* E. T. Cook, *Life of Florence Nightingale*, II: 205.

When these regiments of volunteers began to pour in on Washington in May and June of 1861, their condition was such as to arouse well grounded alarm among patriotic citizens. They "had made their journey in cattle cars as crowded and ill-provided as if they were carrying beasts to the shambles. . . . On arriving no preparations had been made for their reception. Men stood for hours in the broiling sun or drenching rain, waiting in vain for rations and shelter, while their ignorant and inexperienced commissaries and quartermasters were slowly and painfully learning the duties of their positions. At last, utterly worn out and disgusted, they reached their camps where they received rations as unwholesome as distasteful to them and endeavored to recruit their wasted energies while lying upon rotten straw wrapped in a shoddy blanket."*

To help in meeting this situation the United States Sanitary Commission was organized. Its name and the nature of the powers and duties to be given it seem to have been suggested to its originators by the British Sanitary Commission, sent to the East during the Crimean War with plenary powers to reorganize the sanitary conditions of the British army. Soon after the Civil War opened voluntary organizations designed for the relief of the soldiers had sprung up in various parts of the country. New York City took the lead in an effort to combine these organizations, for which purpose a large and representative meeting of women and doctors was held in Cooper Institute May 6, 1861, at which the Women's Central Association of Relief was organized. Its representatives applied first to the Medical Department of the Army in New York, but on meeting with a rebuff turned to the head of the

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*C. J. Stillé, *History of the United States Sanitary Commission*, p. 33.

Medical Bureau in Washington to learn what assistance, if any, the army desired from these voluntary organizations. With them went a distinguished representative of the Physicians and Surgeons of the Hospitals of New York and a representative of the Lint and Bandage Association.

The War Department was then looking forward to a war of the dimensions of the Seminole War or the Mexican War and felt quite competent to deal with it unaided by civilians. The delegation was convinced that prevention was far more important and efficient than relief and that the situation demanded the appointment of a commission with full power to establish a preventive hygienic and sanitary service but found themselves quite unable to bring the acting surgeon-general to their point of view. Because of this disagreement they modified their proposal and in a subsequent memorial to the secretary of war proposed the appointment of a mixed commission of civilians, medical men and military officers "who shall consider . . . the prevention of sickness and suffering among the troops and suggest the wisest methods which the people at large can use to manifest their goodwill towards the comfort, security and health of the army."*

After considering this plan, the acting surgeon-general recommended to the secretary of war the appointment of "A Commission of Inquiry and Advice in respect to the Sanitary Interests of the United States Forces." After hesitating to establish what President Lincoln called "a fifth wheel to the coach," the departmental officials finally adopted the recommendation and launched the commission stripped of nearly all the attributes first desired by its advocates. The officials apparently expected it to be useless, but also harmless, and speedily to disappear. That it flourished instead of withering was due mainly to the energy and wisdom of the commissioners and of their secretary, F. L. Olmsted, who played the part of General Manager. From the start the commission carefully and invariably avoided undertaking any duties devolving on a government official but merely proffered him its aid and sought thus to supplement the resources of the government, material or personal.

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*C. J. Stillé, *History of the United States Sanitary Commission*, p. 528.

As always in such cases, people contributed more readily and generously for relief than for prevention and more readily for prevention than for the expenses of administration. Indeed the commission might early have failed and certainly would have fallen far short of what it did achieve, had it not been for the generosity of California and the adjacent states. Lying, as they did, removed from the scene of conflict perhaps 5,000 miles by the shortest travelled route, they sent no regiments into the northern army. But they were winning streams of gold from their hillsides, and in the fall of 1862 the mayor of San Francisco telegraphed the President that he held a fund of $100,000 raised in that city for sick and wounded soldiers and asked advice about its disposition. The President consulted the surgeon-general, who advised that it be forwarded to the Sanitary Commission. This advice was adopted and before the close of the war the commission received from the Pacific states $1,500,000, or twice as much as the cash contributions from all the rest of the country. Is it fanciful to see an analogy between the relation of California to our Civil War and the relation of the whole United States to the present war in Europe, between the $100,000 telegraphed from San Francisco to Washington in 1862 and the $100,000,000 raised in a week in this country in 1917 by the American Red Cross largely for the relief of stricken Europe?

The next important step in the development of medical sanitary statistics was due in some measure to the work of Dr. J. S. Billings.

Because of his work on the Index Catalogue of the National Medical Library and as designer of the Johns Hopkins Hospital, Billings, during the last quarter of the nineteenth century, was perhaps more widely known abroad than any other American physician. In 1881 he had been invited to make one of the general addresses before the International Medical Congress at London, this being the first time any American had been so honored. His address on "Our Medical Literature" won the greatest approval. At its close the audience rose and shouted and cheered until they were hoarse, after which the President said, "If this single paper were the sole production of the Congress, it was worth coming here to meet in order that it might be produced."[*] Consequently, when Billings was invited, nine years later, to address the section of army surgeons at the Berlin meeting of the same body on the topic, "Can the reports of sickness and deaths in the armies of different nations be made upon an uniform plan in order to obtain comparative statistics of scientific value?" professional expectation was doubtless high. It was not disappointed, for the paper is the ablest analysis I have found of the international aspects of our problem. As a result of the discussion that followed, a special commission was appointed to consider the plans proposed. It advised that an international commission should be appointed to consist of a delegate from the medical department of the army of each coöperating country. To this commission should be referred the task of drafting forms of tables for a uniform international system of military medical statistics. The commission was duly appointed and met, with the United States and ten European countries represented, at Budapest in 1894 in connection with the International Congress on Hygiene and Demography.[†] It recommended:

1. That an annual report about the army's sanitary condition should be published by each country.

2. That the coöperating countries should exchange these publications.

3. That an annual report, showing the results of the physical examinations of recruits, should be published by each country.

4. That these reports should speak for the calendar year.

5. That the annual report on recruits should include

(a) Number subject to draft who were examined;

(b) Number found available for military service;

(c) Number rejected as too short;

(d) Stature of those accepted in gradations of 5 cm. (about 2 inches);

(e) Defects of those rejected according to a list of defects to be decided by each army.

6. That in computing an army's mean strength only the

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[*] F. H. Garrison, *John Shaw Billings: A Memoir*, pp. 231, 241.

[†] A copy of this commission's report printed as a manuscript is in the Surgeon General's Library at Washington.

men and subordinate or non-commissioned officers should be included.

7. That in computing an army's mean strength the persons in hospitals should be included.

8. That a classification of the cases of contagious disease into those occurring during the first year of service and those occurring later should be made.

9. That a classification of the sick into those sick in barracks and those sick in hospital should be made.

10. That a classification of the sick who were discharged into those fit for duty, dead and other cases should be made.

11. That the number of days lost through sickness should be shown.

12. That deaths from accident and suicide should be reported separately from deaths from sickness.

13. That the standard ratio used should be per 1,000, but in certain cases ratios per 100,000 might be introduced.

14. That the international tables should show only a few of the most important diseases arranged alphabetically.

15. That in cases of death the length of service should be shown as within one year, more than one year.

16. That the ages of decedents should be shown as 20–25, 26–30, over 30.

By this survey of the development of military sanitary statistics the following conclusions are suggested as probable:

1. The development of military sanitary statistics has proceeded spasmodically in close association with certain great wars and great statists.

2. The care for the health and efficiency of an army, of which its system of sanitary statistics is an important part, when tested by the strain of a great war has usually been found inadequate.

3. The most promising way in which to diminish the danger of such a breakdown or, if it occurs, to keep its evil results within bounds is by invoking or welcoming the coöperation of civilian sanitarians and statists to take part of the strain off the machine.

4. The breakdown of the army sanitary system may arouse a wave of popular criticism strong enough to overcome official

inertia and devotion to precedent, but this criticism is likely to pass away without leading to important constructive results, unless sanitarians and statists of vision and sound judgment are in a position to guide it into wise channels.

The difference is illustrated by the efficiency of Florence Nightingale and Sidney Herbert and the inefficiency of John Shaw Billings in trying to introduce improvements into military sanitary statistics. The latter was quite as able a statist as either or both of the former, but he had no driving force of public opinion and indignation to give strength to his arm. Thus his efforts at reform (even by introducing mechanical methods) had little permanent result.

5. The difficulties in the way of an effort to get comparable figures of sanitary conditions in the various armies and navies of the world are almost insuperable. Can anyone from existing returns rank the armies of the world in the order of their healthfulness in time of peace or even decide whether in this country the army or the navy is in a better sanitary condition?

THE MORTALITY OF CHILDHOOD.*

By Louis I. Dublin, Ph.D., *Statistician, Metropolitan Life Insurance Company, New York*

There are few authoritative papers in American vital statistics on the mortality of childhood. Such as have appeared, moreover, have been limited for the most part to infant mortality. The other divisions of child life, *i.e.*, the pre-school years and the interesting years of school life, have been virtually overlooked. The annual mortality reports of the United States Bureau of the Census contain the crude basic data on deaths at these ages but make no attempt to analyze the figures. The reports of the health departments of a very few states and cities contain references to their child mortality; but these are casual and scattered and have no great scientific value. In spite of the great interest and importance of the subject, there is today no phase of the whole mortality problem in the United States for which we have less definite information. The public health programme for the conservation of child life has undoubtedly been hampered as a result.

In this paper we shall attempt to bring together the facts with regard to child mortality that are available for the Registration Area of the United States and for a large group of insured children in the families of wage earners in the United States and Canada. The figures which we shall present have, to be sure, some limitations which we shall point out as we proceed. Our prime emphasis throughout will be on the practical uses of these data in public health work for children. First we shall consider the mortality of children for all causes of death combined and later, for the chief causes of death in each of the principal age periods of childhood.

MORTALITY OF CHILDREN: ALL CAUSES OF DEATH COMBINED.

There are two outstanding facts with regard to child mortality: childhood is ushered in with the highest mortality rate and closes with the lowest rate of any divisional period of life. There is, accordingly, a very rapid downward sweep in the death rate from age to age throughout childhood. The mortality during childhood should, therefore, be studied by single years of age; at any rate, during the first five years of life where the most marked changes occur from age to age. After the first quinquennium the mortality may readily be studied by five year periods of age. The following table presents the mortality rates for male and female children under age 15. The figures cover the six year period 1910 to 1915 for the expanding Registration Area of the United States. The populations have been estimated by means of the arithmetic annual increment method, using the annual estimates of total population for the Registration Area and distributing the sum by sex and age period on the basis of the distribution found by the 1910 Census.

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*Paper read at the seventy-ninth Annual Meeting of The American Statistical Association.

TABLE I.

ESTIMATED POPULATION,* DEATHS AND DEATH RATES PER 1,000, EXPANDING REGISTRATION AREA OF UNITED STATES, 1910 TO 1915, AGES UNDER 15 YEARS. MALES AND FEMALES COMPARED.

Age Period.	Males.			Females.		
	Estimated Population.	Deaths.	Rate per 1,000.	Estimated Population.	Deaths.	Rate per 1,000.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Under 1	4,079,018	513,338	125.8	3,965,102	400,883	101.1
1	3,635,315	99,319	27.3	3,535,519	88,256	25.0
2	3,987,611	43,682	11.0	3,875,231	39,129	10.1
3	3,940,004	27,156	6.9	3,884,218	24,549	6.3
4	3,894,300	19,732	5.1	3,779,968	17,868	4.7
Total under 5	19,536,248	703,227	36.0	19,040,038	570,685	30.0
5 to 9	17,609,764	58,378	3.3	17,257,519	52,205	3.0
10 to 14	16,870,390	38,653	2.3	16,603,960	35,135	2.1
Total under 15	54,016,402	800,258	14.8	52,901,517	658,025	12.4

* Thanks are due to the Prudential Insurance Company and to the Census Bureau for basic data used in estimating these populations.

Columns 4 and 7 in Table I show the death rates for males and females respectively in the several age periods. The highest mortality occurs, of course, under age one; 125.8 and 101.1 for males and females respectively. These figures must be distinguished from the so-called infant mortality rates which are based on the number of births reported. A sharp decline is observed in the death rate for the next year of life, between age one and two. The rates are then 27.3 and 25.0 for males and females. The rate of decline during the next three years of life is less marked. At the age period two to three years the rates are 11.0 and 10.1 for males and females and in the next age period, three to four years, the rates reach the comparatively low figures of 6.9 and 6.3 per 1,000 for males and females. At age four to five years the figures are 5.1 and 4.7 per 1,000 for males and females respectively. After age 5, the decline in the death rate is slight for each succeeding individual year. For the entire age period five to nine years the death rate is for both sexes but slightly over 3 per 1,000. For the period 10 to 14 years the rate is not much more than 2 per 1,000 exposed. The minimum during the whole range of life is then attained. It should be noted that the mortality rates for males are uniformly higher than for females throughout the entire period of childhood, although it has been widely observed that the rates for the two sexes converge almost to identity at about age 13. After this point, the rates for the two sexes diverge again, the females showing progressively lower figures of mortality than the males. The general trend of the rates is, however, much the same for each sex.

The rates of mortality in this table apparently are regular in their downward course and in themselves do not suggest any internal technical difficulties. It is a well established fact, however, that the estimated population of the ages of childhood based upon the Census enumerations is far from perfect. The population under 1 year of age is practically always under-enumerated. The enumeration of population at the period one to two years is also too low as is indicated in columns 2 and 5 of Table I by the fact that the number is less than for any succeeding year in the period 1 to 5. Thereafter, the ages 2, 3 and 4 last birthday do not present substantial difficulties for our purposes. The number of persons living declines with each succeeding year of age in practical accordance with the death rate at these ages. We may, therefore, say that the mortality rates presented in columns 4 and 7 are somewhat higher than they should be in the first two years of life and that thereafter up to age 15 they probably approach closely to the true facts of child mortality in the area covered.

To overcome the difficulties involved in the above table which result from the defective enumeration of children at the youngest ages, we may profitably use the figures in the recently prepared United States Life Tables 1910. In these tables, Prof. J. W. Glover, who supervised the compilations, smoothed or graduated the populations recorded at the several age periods of childhood, following the method employed in the preparation of the German tables for the period 1891 to 1900. As a result of these smoothing processes, he obtained rates which are in all probability a closer approach to the true facts of mortality for the individual years of life in childhood than are the unadjusted figures presented in Table I. We present in Table II the values obtained by Professor Glover. They cover the three calendar years 1909 to 1911 and relate to the original registration states as constituted in 1900. It should be noted that these figures are not central death rates but are based upon the estimated populations at the beginning of each age period.

TABLE II.

DEATH RATES AT SINGLE AGES UNDER FIVE YEARS AND BY FIVE YEAR AGE PERIODS THEREAFTER UP TO AGE FIFTEEN, ORIGINAL REGISTRATION STATES—1909-1911. MALES AND FEMALES COMPARED.

Age Period.	Death Rate per Thousand.	
	Males.	Females.
0-1	125.0	103.8
1-2	28.8	26.4
2-3	13.0	11.6
3-4	8.1	7.6
4-5	5.8	5.5
Total under 5	39.3	33.2
5-10	3.6	3.3
10-15	2.4	2.2
Total under 15	15.7	13.3

A comparison of the rates in Tables I and II confirms the essential facts already brought out with regard to the mortality from all causes combined in the period of childhood. The death rate for males in childhood is at every point higher than for the females. The rates of decline in mortality from age period to age period are also much alike in both tables. In fact, beginning with age 4 last birthday, the figures for the Registration States 1909 to 1911 and for the Registration Area 1910 to 1915 are very much alike. Such differences as appear in the two tables after age four are probably due to the somewhat different areas covered and to the different years of experience employed. The mortality rate of children has been somewhat on the decline since 1910 and this is shown in the lower rates in the later figures for the Registration Area. Figures prepared by us for the Registration Area for the years 1909, 1910 and 1911 approach the Glover figures much more closely.

TABLE III.

DEATH RATES PER 1,000. EXPANDING REGISTRATION AREA, 1910 to 1915, ORIGINAL REGISTRATION STATES, 1909 to 1911, AND WHITE LIVES, INDUSTRIAL DEPARTMENT, METROPOLITAN LIFE INSURANCE COMPANY, 1911 to 1916 COMPARED. SINGLE YEARS OF AGE UNDER FIVE; FIVE YEAR AGE PERIODS THEREAFTER UP TO AGE FIFTEEN.

Age Period.	Males.			Females.		
	Exp. Reg. Area 1910 to 1915.	Orig. Reg. States 1909 to 1911.	M.L.I. Co. White Ind'l 1911 to 1916.	Exp. Reg. Area 1910 to 1915.	Orig. Reg. States 1909 to 1911.	M.L.I. Co. White Ind'l 1911 to 1916.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Under 1	125.8	125.0	—	101.1	103.8	—
1	27.3	28.8	—	25.0	26.4	—
2	11.0	13.0	—	10.1	11.6	—
3	6.9	8.1	8.1	6.3	7.6	7.6
4	5.1	5.8	6.0	4.7	5.5	5.5
Total under 5	36.0	39.3	—	30.0	33.2	—
5 to 9	3.3	3.6	3.6	3.0	3.3	3.3
10 to 14	2.3	2.4	2.3	2.1	2.2	2.2
Total under 15	14.8	15.7	—	12.4	13.3	—

A third source of data is available in the mortality figures for the Industrial Department of the Metropolitan Life Insurance Company, which has a large exposure of children. Unfortunately, the actuarial* necessities of the case make a comparison of the data impossible for the ages one and two last birthday. Thereafter, that is, beginning with age 3, the rates are, as is seen in columns 4 and 7 of Table III, consistent with those previously presented in Tables I and II and indicate that the insurance experience for the children of the wage earners of America approximates fairly well the mortality of children in the general population. Limitation is made in these insurance figures to white lives and the period covered is for the six years 1911 to 1916. The experience includes nearly all the states of the United States and the Provinces of Canada.

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* The insurance experience contains no children under one year of age. This experience is also compiled on the "Calendar year basis," that is, the age of the lives exposed is automatically advanced one year on each January 1 irrespective of the actual age of the insured at that time. This actuarial process results in advancing the ages of the young children so appreciably that the rates obtained for ages 1 and 2 last birthday are not comparable with population rates. Beginning with age 3 last birthday and thereafter the processes of the calendar year method balance each other at the beginning and at the end of each year of age and the rates obtained are, as a result, comparable with population figures for the same ages

PRINCIPAL CAUSES OF DEATH IN CHILDHOOD.

Certain diseases and conditions are preëminently those of childhood. The causes peculiar to early infancy, the acute infectious diseases such as measles, scarlet fever, whooping cough and diphtheria, and the nutritional diseases such as infantile diarrhea and enteritis, are encountered almost entirely in children under 15 and have a negligible incidence beyond that age. On the other hand, conditions such as tuberculosis, all forms of pneumonia, and certain traumatisms, while more or less prevalent in childhood are found appreciably in other periods of life. Interest centers in the diseases of childhood because they have proved a very fruitful field of research for the medical investigator even if much promising work still remains to be carried out. A consideration of the causes of death in childhood is, moreover, indispensable from the standpoint of public health service and the prevention of disease generally. We shall in the following discussion consider the several important causes of death in each one of the age periods, both as to relative importance and as to the actual rates of mortality incidence. For this purpose we shall use as our basic material the returns for the expanding Registration Area for the 6-year period from 1910 to 1915 and the data of the Industrial Department, Metropolitan Life Insurance Company, from 1911 to 1916. It is encouraging in connection with this proposed discussion that we are concerned with deaths that are, for the most part, well reported and fairly reliably stated as to cause.

THE FIRST YEAR OF LIFE.

In the first year of life, a very few diseases and conditions account for the larger part of the mortality. Thus, the group of conditions included under the terms congenital debility and malformations and the injuries at birth together account for 37.6 per cent. of the total. Next in importance we find diarrhea and enteritis with 24.4 per cent. of the total deaths. The respiratory diseases which are for the most part bronchopneumonia, but which literally include lobar and undefined pneumonia as well as bronchitis, are together responsible for 15.5 per cent. of the deaths. We see, therefore, that three groups of causes alone account for nearly four-fifths of the total mortality of the first year of life (77.5 per cent.).

The remainder of the mortality is distributed over a considerable number of conditions no one of which is of preëminent importance. The four important communicable diseases of childhood, which we shall find very prominent in our discussion at the other age periods, are not represented to any large degree in the first year of life, with perhaps the exception of whooping cough which accounts for 2.3 per cent. of the total deaths. The highest rate for whooping cough at any age is found in the initial year of life. In fact, over one-half of all the deaths from this disease are located in this first age group. A large proportion of the deaths from measles are also found in this first year of life. The relative significance of measles to all causes is not as great, however, as we shall find it in the later periods. Tuberculosis looms larger in this age period than any of the acute infectious diseases named, except whooping cough. About one-half of the tuberculosis deaths are from tuberculous meningitis. Finally, syphilis, which is undoubtedly under-registered at present, is noted in 1.2 per cent. of the total deaths. In view of the high total mortality, we find the rate for this condition extraordinarily high, 137.6 per 100,000; higher in fact than is found at any other age period in life. Other diseases such as meningitis, convulsions, "other diseases of the stomach" and the "ill-defined diseases" are so unreliable in their certification that it is not desirable to refer to them in any fulness. As registration improves, they will be found more and more under the more definite titles referred to above. At present, however, they account for an appreciable part of the infant mortality.

The following table presents the important conditions in the first year of life, giving the percentage of each cause to all causes as well as the rate per 100,000 exposed at the age period. It was not thought necessary to give any detailed analysis of the figures by sex because the conditions affect the two sexes very similarly. Noteworthy sex differences appear only for whooping cough which is more prevalent as a cause of death among females, and for the causes peculiar to early infancy, such as injuries at birth, which are much more frequent as causes of death of male babies. This fact is in agreement with what is well known in obstetrical practice, namely, that the larger male baby is more subject to injury than the smaller female child.

Since no insurances are written by the Metropolitan on the lives of children under one year of age no comparative insurance mortality data can be quoted for the first year of life.

TABLE IV.

CAUSES OF DEATH IN FIRST YEAR OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910–1915.

Cause of Death.	Per cent. Total Deaths.	Rate per 100,000.
All causes	100.0	11365.1
Whooping cough	2.3	257.2
Tuberculosis—all forms	1.6	183.8
Tuberculosis of the lungs	.6	66.4
Tuberculous meningitis	.8	84.7
Syphilis	1.2	137.6
Bronchitis	2.5	280.1
Bronchopneumonia	8.1	919.1
Pneumonia—lobar and undefined	4.9	551.4
Diarrhea and enteritis	24.4	2768.6
Congenital malformations—total	5.6	637.5
Hydrocephalus	.4	43.3
Congenital malformations of the heart	3.5	392.2
Other congenital malformations	1.8	202.0
Congenital debility, icterus and sclerema—total	25.9	2946.3
Premature birth	16.8	1909.6
Congenital debility, "atrophy," marasmus	9.1	1036.7
Other causes peculiar to early infancy—total	6.1	696.0
Injuries at birth	3.3	370.1
Other causes peculiar to early infancy	2.7	301.0

THE SECOND YEAR OF LIFE.

The causes responsible for the mortality during the second year of life present a somewhat different picture from that found in the earlier year. The conditions associated with prematurity and with the congenital defects are no longer present to any degree. On the other hand, diarrhea and enteritis continue to play a most important part in the total mortality and are, in fact, the first causes of all in the second year of life; over one quarter of the deaths (27.3 per cent.) are due to this single condition. Next in importance are the respiratory diseases which include bronchopneumonia, pneumonia lobar and undefined and bronchitis. They were responsible for 26.4 per cent. of the deaths in the second year of life. Bronchopneumonia still accounts for the most part of these deaths. The four epidemic diseases, measles, scarlet fever, whooping cough and diphtheria now play a much more prominent part in the total mortality. Together, they account for 17.8 per cent. of all the deaths. Diphtheria is the most important of the four and reaches its highest death rate in any year of life. It is followed by measles with nearly the same rate and by whooping cough and scarlet fever in the order named. Tuberculosis rises in this year into a more prominent position, relatively, than in the first year of life but the actual rate per 100,000 exposed, is somewhat lower. Tuberculous meningitis forms over one-half of the total tuberculosis mortality. Finally, we must take the accidents into consideration, in this second year of life; burns alone now are responsible for 1.7 per cent. of the deaths with a rate of 44.1 per 100,000 exposed and, as we shall see, this condition as well as other accidental causes becomes more and more prominent with the advancing ages of childhood.

Males showed higher mortality rates than females in the second year of life for measles (154 and 142, respectively, per 100,000), scarlet fever (47 and 41 per 100,000), diphtheria and croup (164 and 138 per 100,000), tuberculosis, all forms (156 and 141 per 100,000), tuberculous meningitis (83 and 78 per 100,000), bronchopneumonia (393 and 358 per 100,000), pneumonia, lobar and undefined (266 and 232 per 100,000) and diarrhea and enteritis (747 and 678 per 100,000). Whooping cough showed a higher female rate (138 per 100,000). The male rate was 105 per 100,000.

As before, there is an appreciable mortality registered for conditions such as dysentery, meningitis, "other diseases of the stomach" and "ill-defined diseases," which are reported so unreliably that no reference is made to them in our Table V which follows:

TABLE V.

CAUSES OF DEATH IN SECOND YEAR OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910–1915.

Cause of Death.	Per Cent. Total Deaths.	Rate per 100,000.
All causes	100.0	2615.8
Measles	5.7	148.1
Scarlet fever	1.7	43.9
Whooping cough	4.6	120.9
Diphtheria and croup	5.8	151.0
Tuberculosis—all forms	5.7	148.2
Tuberculosis of the lungs	1.8	47.1
Tuberculous meningitis	3.1	80.7
Bronchitis	2.5	65.3
Bronchopneumonia	14.4	375.9
Pneumonia—lobar and undefined	9.5	249.1
Diarrhea and enteritis	27.3	713.2
Burns	1.7	44.1

THE THIRD YEAR OF LIFE.

The facts of this age period show a further shift in the relative importance of the several causes of death. The four chief epidemic diseases are now of the first importance, being responsible together for more than one fourth of the deaths (26.4 per cent.). Diphtheria is by far the most prominent of the four and its rate is not much less than for the second year of life when the mortality from all causes was more than twice as great. Scarlet fever while now relatively more prominent has much the same rate as in the preceding year; but the rates for measles and whooping cough have dropped to a little more than one third what they were in the second year. The respiratory conditions including the same diseases listed in the previous discussion, are now responsible for 22.0 per cent. of the total mortality. Bronchopneumonia is still the chief item in this list. Diarrhea and enteritis have declined perceptibly in their proportionate incidence and even more so in the rate, although their importance is not yet to be discounted. The proportionate incidence of tuberculosis has increased also, although the rate per 100,000 has decreased to about one half of the previous one. Tuberculous meningitis is again the prominent form of tuberculosis in this year of life. Accidents and injuries, as might be expected, play an increasingly important part. It is at this age that children begin to manifest extraordinary curiosity about the affairs of the household and their environment generally and indulge in all the activities of the runabout-child. Burns are the most important of the accidental causes of death, being responsible for 4.3 per cent. of the deaths. The rate is practically the same as in the preceding year. We also observe that falls begin at this age period to become an important cause of mortality among children. Attention should also be directed to the beginning importance of typhoid fever, which now is responsible for 1 per cent. of the deaths with a rate of 10.3 per 100,000 exposed.

Measles shows only a slightly higher death rate for males than for females as does also scarlet fever, tuberculosis, all forms, tuberculous meningitis, and bronchopneumonia. Diphtheria mortality is considerably higher for males (136 per 100,000) than for females (122 per 100,000). Pneumonia, lobar and undefined shows a male rate of 98 which may be compared with a female rate of 89 per 100,000. Diarrhea and enteritis shows rates of 143 and 130 per 100,000 for males and females respectively in the third year of life. Burns show a male mortality rate of 49 and a female rate of 40 per 100,000. Traumatism by fall shows, comparatively, a rate of 11 for males and 7 per 100,000 for females.

Several conditions such as dysentery, meningitis, acute nephritis, acute poisonings and ill-defined diseases are registered in significant proportions but their rates, in view of the declining total mortality, are not large enough to warrant any extended treatment, especially in view of the indefinite character of most of these titles or of their unreliability as statements of cause of death. The chief facts for the third year of life are shown in Table VI.

TABLE VI.

CAUSES OF DEATH IN THIRD YEAR OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910–1915.

Cause of Death.	Per cent. Total Deaths.	Rate per 100,000.
All causes	100.0	1053.2
Typhoid fever	1.0	10.3
Measles	5.5	58.3
Scarlet fever	4.7	49.7
Whooping cough	4.0	42.5
Diphtheria and croup	12.2	128.8
Tuberculosis—all forms	7.2	75.5
Tuberculosis of the lungs	2.2	22.8
Tuberculous meningitis	3.9	40.9
Bronchitis	2.0	20.6
Bronchopneumonia	11.1	116.9
Pneumonia—lobar and undefined	8.9	93.4
Diarrhea and enteritis	13.0	136.8
Burns	4.3	44.8
Traumatism by fall	.9	9.2

THE FOURTH YEAR OF LIFE.

The fourth year of life witnesses another marked reduction in the total mortality rate from the figure of the preceding year. From this age onward the reduction in the mortality from all causes is comparatively slight. The four epidemic diseases together are now responsible for about one third of the total mortality. The chief of these four is diphtheria which accounts for over a sixth of the deaths in both the population and insurance experiences. The respiratory diseases and conditions are of less importance in the fourth year of life than in the preceding age, both in relation to all causes of death and to the exposure. They constitute the second important group with 16.8 per cent. of the deaths among children in the general population and 18.1 per cent. among insured children. In both experiences, respiratory diseases and conditions combined have approximately the same number of deaths as the single cause of death, diphtheria. Bronchopneumonia is still the most commonly reported form of respiratory disease, although lobar pneumonia shows an increasing ratio of importance in the mortality from these conditions. Tuberculosis, all forms, has a slightly higher relative incidence than in the earlier year; the rate is one third lower, however. Tuberculous meningitis is still the important form of this disease, in both the population and insurance experiences.

Diarrhea and enteritis, a group of diseases and conditions which constitute the fourth cause as to prominence among all deaths in the fourth year of life, are now much less significant than in the preceding ages. They are recorded in 7.3 per cent. of the deaths among population children with a rate of 48.4 per 100,000, and in 8.0 per cent. of the deaths of insured children at a rate of 62.7 per 100,000 exposed. Accidents and injuries show an increase in the proportion of all deaths, but with only a slight decrease in the rate per 100,000 of population. Burns are by far the most prominent accidental cause of death. Traumatism by fall is recorded in about 1 per cent. of the deaths. Vehicular accidents, of which automobile accidents are a prominent element, assume prominence in this age with 1.6 per cent. of the total deaths in both the population and insurance experience.

Typhoid fever shows a similar rate of mortality in this age as in the preceding one, although its relative importance is somewhat increased.

In making these comparisons between the mortality of children in the general population and in the insurance experience, it must be borne in mind continually that the population embraces a considerable rural area while insured children live for the most part in large cities, where the factors of congestion of population affect the incidence and fatality of certain of the epidemic diseases. Traffic conditions likewise tend to increase the mortality rate from accidents of city children.

The mortality rates of the two sexes deserve passing comment. Measles, scarlet fever, tuberculosis and bronchopneumonia show no very significant differences in the mortality rates of males and females in the fourth year of life. Diphtheria, however, continues to show a considerably higher rate for males, 120 per 100,000, than for females, 105 per 100,000. Pneumonia, lobar and undefined was indicated at a rate of 54 per 100,000 for males and only 47 per 100,000 for females. Diarrhea and enteritis had a rate of 52 for males and 45 for females. Traumatism by fall showed a higher rate for males, 8 per 100,000, than for females, 5 per 100,000, as did also automobile accidents and injuries where the male rate was 4 per 100,000 and the female rate was only 2 per 100,000.

The ill-defined causes of death and a number of others which are in effect terminal conditions of the acute infections are present in this age group as before, but find no proper place in our Table VII which follows:

TABLE VII.

CAUSES OF DEATH IN FOURTH YEAR OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910-1915, AND METROPOLITAN LIFE INSURANCE CO., INDUSTRIAL DEPARTMENT, WHITE LIVES, 1911 TO 1916.

Cause of Death.	Per cent. Total Deaths.		Rate per 100,000.	
	Reg. Area.	M.L.I. Co.	Reg. Area.	M.L.I. Co.
All causes	100.0	100.0	660.8	788.8
Typhoid fever	1.5	1.4	10.2	11.1
Measles	4.4	5.7	29.1	45.3
Scarlet fever	7.0	5.8	46.1	46.1
Whooping cough	3.2	3.5	21.1	27.9
Diphtheria and croup	17.0	18.1	112.2	147.2
Tuberculosis—all forms	7.7	7.2	50.5	56.9
Tuberculosis of the lungs	2.3	1.7	15.3	13.0
Tuberculous meningitis	4.0	4.4	26.7	34.7
Bronchitis	1.4	1.7	8.9	13.2
Bronchopneumonia	7.8	9.3	51.4	73.0
Pneumonia—lobar and undefined	7.6	7.1	50.5	56.1
Diarrhea and enteritis	7.3	8.0	48.4	62.7
Burns	5.9	5.0	38.8	39.4
Traumatism by fall	1.0	1.1	6.8	8.4
Total vehicular accidents	1.6	1.6	10.5	12.9

THE FIFTH YEAR OF LIFE.

In the last of the first five years of life, the total mortality rate has again declined from that of the preceding year. The changes of the relative importance of the individual conditions are also few and unimportant both in the insurance and general population experiences. In fact much the same picture is presented by Table VIII as in the preceding one; our discussion of this age is, therefore, necessarily brief. Attention need be directed only to the increasing prominence of typhoid fever, to the appearance for the first time of appendicitis as a condition deserving comment, and to the presence of the organic heart diseases which are the cause of 1.6 per cent. of all the deaths in the fifth year of life among population children, and for 1.2 per cent. among deaths of insured children. It is possible, of course, that the latter diseases as well as acute nephritis which we have not included in our table but which is also reported in 1.3 per cent. of the deaths of population children, are in large measure the sequelae of the epidemic diseases. Reference should also be made to the increasing incidence of the vehicular accidents which are in this age period responsible for 2.5 per cent. of the total mortality in both experiences. The automobile accidents are by far the most prominent of the individual conditions under this head.

Apart from a few conditions, there are no very significant differences between the population and insurance experiences among children in this year of life.

TABLE VIII.

CAUSES OF DEATH IN FIFTH YEAR OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910-1915, AND METROPOLITAN LIFE INSURANCE CO., INDUSTRIAL DEPARTMENT, WHITE LIVES, 1911 TO 1916.

Cause of Death.	Per cent. Total Deaths.		Rate per 100,000.	
	Reg. Area.	M.L.I. Co.	Reg. Area.	M.L.I. Co.
All causes	100.0	100.0	489.9	576.0
Typhoid fever	2.2	2.0	10.6	11.5
Measles	3.5	4.5	17.1	25.6
Scarlet fever	7.6	7.4	37.3	42.8
Whooping cough	2.4	2.5	11.5	14.4
Diphtheria and croup	18.8	22.2	92.3	128.0
Tuberculosis—all forms	7.7	7.0	37.6	40.4
Tuberculosis of the lungs	2.5	1.7	12.3	9.6
Tuberculous meningitis	3.8	4.1	18.4	23.4
Organic diseases of the heart	1.6	1.2	7.8	6.6
Bronchitis	1.1	1.2	5.2	7.0
Bronchopneumonia	6.0	6.4	29.2	36.6
Pneumonia—lobar and undefined	6.8	6.3	33.5	36.2
Diarrhea and enteritis	5.0	5.3	24.5	30.6
Appendicitis	1.4	1.0	7.0	5.5
Burns	5.7	5.5	28.1	31.6
Traumatism by fall	1.1	.9	5.2	5.1
Total vehicular accidents	2.5	2.5	12.3	14.2
Automobile accidents and injuries	.8	.9	3.8	5.3

THE SECOND QUINQUENNIUM OF LIFE—AGES 5 TO 9 YEARS.

The second five years of life are characterized by extremely low mortality rates in both experiences of population and insured children. The interrelations between the several causes of death are in the main different from those we have previously described. We are now concerned with a very much larger list of diseases and conditions, a considerable number of which have made their appearance for the first time in any appreciable degree. These include certain organic conditions which are indicative of degenerative processes. Of the epidemic diseases of childhood only two now merit attention, scarlet fever and diphtheria. Measles and whooping cough play comparatively minor parts in the total mortality between ages 5 and 9. Typhoid fever has increased to a respectable figure, 3.7 per cent. of all deaths and a rate of 11.0 per 100,000 for general population children, and 2.9 per cent. and a rate of 10.0 per 100,000 for insured children. Tuberculosis becomes a little more important as a factor of mortality in this period and from now on will be found to increase continuously in its rate for a long period of years. Tuberculous meningitis for the first time in childhood becomes a less important form of this disease than pulmonary tuberculosis. Pneumonia, all forms, is still among the more prominent causes of death; and bronchopneumonia has fallen much below lobar pneumonia in its incidence. Appendicitis has approximately the same mortality rate as typhoid fever in both general population and insurance experiences. The accidents and injuries are prominent and such conditions as falls, accidental drowning and the vehicular accidents, chief of which are the automobile accidents, demand more and more of our attention.

Concerning the organic conditions referred to above, we must direct especial attention to acute articular rheumatism, diabetes, acute endocarditis, organic diseases of the heart and acute nephritis and Bright's disease. Some of these are undoubtedly idiopathic but most of them, probably, are either the immediate or ultimate sequelae of the epidemic diseases of childhood.

TABLE IX.

CAUSES OF DEATH IN SECOND QUINQUENNIUM OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910–1915, AND METROPOLITAN LIFE INSURANCE CO., INDUSTRIAL DEPARTMENT, WHITE LIVES, 1911 TO 1916.

Cause of Death.	Per cent. Total Deaths.		Rate per 100,000.	
	Reg. Area.	M.L.I. Co.	Reg. Area.	M.L.I. Co.
All causes	100.0	100.0	317.2	348.7
Typhoid fever	3.7	2.9	11.6	10.0
Measles	2.5	3.1	7.8	10.9
Scarlet fever	7.1	6.8	22.5	23.8
Whooping cough	1.2	1.1	3.9	3.9
Diphtheria and croup	15.8	19.8	50.2	69.1
Tuberculosis—all forms	8.7	8.0	27.7	27.8
Tuberculosis of the lungs	3.5	2.7	11.2	9.4
Tuberculous meningitis	3.4	3.7	10.7	12.7
Acute articular rheumatism	2.0	2.3	6.4	8.0
Diabetes	.9	.5	3.0	1.7
Acute endocarditis	1.3	1.2	4.3	4.2
Organic diseases of the heart	4.4	4.8	14.0	16.6
Bronchitis	.7	.7	2.2	2.5
Bronchopneumonia	3.5	3.5	11.1	12.2
Pneumonia—lobar and undefined	5.9	5.1	18.7	17.7
Diarrhea and enteritis	2.5	2.4	8.0	8.3
Appendicitis	3.5	2.9	11.2	10.2
Acute nephritis	1.4	.9	4.3	3.2
Bright's disease	1.3	1.2	4.3	4.2
Burns	2.7	2.7	8.6	9.6
Accidental drowning	2.6	3.0	8.3	10.6
Traumatism by fall	1.3	1.2	4.1	4.2
Total vehicular accidents	4.4	5.0	13.9	17.5
Automobile accidents and injuries	1.8	2.5	5.6	8.8

THE THIRD QUINQUENNIUM OF LIFE—AGES 10 TO 14 YEARS.

This age group is characterized by the lowest mortality rate of any divisional period of life. In fact, for all causes of death combined the rate, 2.2 per 100,000 in both the population and insurance experience is less than the rate for some individual diseases in some age quinquennia. The few deaths which do occur in this closing age period of childhood are distributed over a large number of single conditions or causes of death, not any one of which is of great numerical importance. Tuberculosis is the chief cause of death in this divisional period of life, being responsible for 14.8 per cent. of all deaths in the population experience and for 12.8 per cent. in the insurance experience. The death rate for tuberculosis was 32.7 per 100,000 for children in the general population and 28.6 for insured children at this age period. Of these tuberculosis deaths, two thirds are of the pulmonary type. Abdominal tuberculosis appears for the first time as a significant cause of death, and requires notice as does also tuberculous meningitis. Typhoid fever has a higher rate than in the preceding age group, but shows a lower mortality rate among insured than among the population children. Appendicitis, likewise, shows an increased prominence in both series in this quinquennium.

Measles and whooping cough are no longer of any great consequence as causes of death in this age period. Scarlet fever and diphtheria give significant mortality figures for the last time. Between 10 and 15 years of age scarlet fever accounts for 3 per cent. of the deaths in both experiences and diphtheria for approximately 6 per cent. of the deaths. The respiratory diseases and conditions show satisfactory declines from the rates in earlier age periods. In this age period pneumonia mortality shows its lowest rate of incidence in any age period of life.

The acute infections, generally, are now replaced in significance by such grave diseases as organic diseases of the heart, acute articular rheumatism, diabetes and acute endocarditis. Organic diseases of the heart are responsible for 12.0 per cent. of the deaths among insured children and for 8.6 per cent. of the deaths among population children of this age group. Acute articular rheumatism showed a ratio of 3.0 per cent. of all deaths for population children and 3.4 per cent. for insured children. Diabetes showed a higher percentage and death rate among children in the general population.

Nephritis and Bright's disease together accounted for 3.5 per cent. of all the deaths among population children and for 2.9 per cent. among insured children.

Accidents and injuries as a group occupied a prominent position in the total mortality, and the vehicular accidents as well as accidental drowning and traumatism by firearms are especially important as causes of death ascribed to this third quinquennium.

Considered by sex, we find that males have a slightly higher mortality from measles, from scarlet fever, bronchopneumonia, and pneumonia, lobar and undefined. For traumatism by fall males show a rate of 4.8 per 100,000 which may be compared with a figure of 1.3 for females in the general population. Automobile accidents and injuries had a rate of 5.5 per 100,000 for males and 1.0 per 100,000 for females in the third quinquennium of life.

The facts available for this age group in both the population and insurance experience are shown in the following Table X.

TABLE X.

CAUSES OF DEATH IN THIRD QUINQUENNIUM OF LIFE. PERCENTAGE OF TOTAL DEATHS AND RATES PER 100,000, EXPANDING REGISTRATION AREA OF THE UNITED STATES 1910–1915, AND METROPOLITAN LIFE INSURANCE CO., INDUSTRIAL DEPARTMENT, WHITE LIVES, 1911 TO 1916.

Cause of Death.	Per cent. Total Deaths.		Rate per 100,000.	
	Reg. Area.	M.L.I. Co.	Reg. Area.	M.L.I. Co.
All causes	100.0	100.0	220.4	224.0
Typhoid fever	6.4	5.8	14.2	12.9
Measles	1.0	.7	2.2	1.6
Scarlet fever	3.0	3.0	6.6	6.7
Whooping cough	.2	.1	.5	.3
Diphtheria and croup	5.6	6.4	12.2	14.2
Tuberculosis—all forms	14.8	12.8	32.7	28.6
Tuberculosis of the lungs	10.2	8.5	22.4	19.0
Tuberculous meningitis	2.2	2.1	4.7	4.7
Abdominal tuberculosis	1.0	.8	2.2	1.7
Acute articular rheumatism	3.0	3.4	6,5	7.7
Diabetes	2.2	1.6	4.9	3.6
Acute endocarditis	1.8	1.9	3.1	4.2
Organic diseases of the heart	8.6	12.0	18.9	27.0
Bronchitis	.3	.3	.7	.6
Bronchopneumonia	1.4	1.3	3.2	2.9
Pneumonia—lobar and undefined	5.3	4.5	11.7	10.1
Diarrhea and enteritis	.9	.9	2.1	2.1
Appendicitis	6.3	6.3	13.8	14.1
Acute nephritis	1.2	.8	2.7	1.8
Bright's disease	2.3	2.1	5.0	4.7
Burns	1.0	1.1	2.2	2.4
Accidental drowning	4.4	6.0	9.7	13.4
Traumatism by firearms	1.9	1.3	4.1	2.9
Traumatism by fall	1.4	1.3	3.1	3.0
Total vehicular accidents	4.4	5.3	9.6	11.9

SUMMARY OF MORTALITY OF CHILDHOOD.

We have presented in some detail the main facts of mortality in each of the age classes of childhood. We may now summarize our discussion for the entire period, considering primarily the characteristics of the principal groups of causes of death affecting children.

We may conveniently group these causes of death under six heads as follows:

i. Causes indicative of prematurity, of congenital debility or of injury at birth.

ii. Diseases and conditions of the digestive tract.

iii. Diseases and conditions of the respiratory system.

iv. The principal epidemic diseases of childhood: measles, scarlet fever, whooping cough and diphtheria.

v. Accidents and injuries.

vi. Important infectious and organic diseases of miscellaneous order.

I. CAUSES INDICATIVE OF PREMATURITY, OF CONGENITAL DEBILITY OR OF INJURY AT BIRTH.

These causes of death affect, primarily, the first year of life when they are responsible for more than three eighths of the mortality. Only congenital malformations appear to any extent among the deaths after the first year. Yet so great is their importance numerically during infancy that close to a quarter of all the deaths under age fifteen are found registered under these titles.

These causes, for the most part, reflect the influence of prenatal conditions on the child. The health of the mother, her habits and the character of her employment during pregnancy play a large part in this phase of infant mortality. Parental alcoholism and syphilis are perhaps the most potent single factors, although unskilled obstetrical care is still to be considered important.

Male infants show uniformly a higher incidence from these conditions.

II. DISEASES AND CONDITIONS OF THE DIGESTIVE TRACT.

It is advisable to consider only the diarrheal diseases of children, although a number of other, but numerically insignificant, conditions could properly be included under this head. The diarrheal diseases account for a little more than 20 per cent. of the total mortality of children under 15 years of age. They are of great importance throughout the entire range of childhood but the highest mortality is found in the first year of life. In the second year of life the rate is reduced to about one-quarter of what it was in the first year although it is the first of all causes in its relative importance at this age. For each age thereafter, there is a progressive decline up to and including the age period 10 to 14 years, when the minimum death rate for childhood is reached. Throughout the years of childhood, the male death rate from diarrheal diseases is higher than the female death rate, the excess of male over female mortality being more pronounced at the very early years of childhood.

III. DISEASES AND CONDITIONS OF THE RESPIRATORY SYSTEM.

This group includes bronchopneumonia, pneumonia—lobar and undefined, and bronchitis. Together, these diseases account for 16.4 per cent. of all the deaths in the ages of childhood. Bronchopneumonia is by far the most important of these causes of death with 8.3 per cent. of the total mortality followed by pneumonia—lobar and undefined with 5.9 per cent. and by bronchitis with 2.1 per cent. of all the deaths. The highest death rate for the diseases of the respiratory system is recorded in infancy. The mortality declines with each succeeding age period until the minimum is found in the years 10 to 14. Significant differences in the mortality of the two sexes appear only for the first 4 or 5 years of life. For the ages of childhood after 5 years, the sex differences are not very significant.

IV. THE PRINCIPAL EPIDEMIC DISEASES OF CHILDHOOD: MEASLES, SCARLET FEVER, WHOOPING COUGH AND DIPHTHERIA.

These four conditions account for 10.7 per cent. of all the deaths recorded in our study of this 15 year period of life. Diphtheria is the most important of the four followed by whooping cough, measles and scarlet fever in the order named. These diseases vary somewhat in their points of maximum incidence. The highest mortality from whooping cough is found in infancy. Measles and diphtheria show their highest mortality rates in the second year of life and scarlet fever in the third year of life, that is, between 2 and 3 years of age. After their points of maximum incidence, these diseases decline, although not at the same rate, to a minimum point in the age period 10 to 14 years. Scarlet fever has a mortality rate in the second, third and fourth years of life which varies but little from the maximum point of 49.7 per 100,000 in the third year of life. The other three of these chief epidemic diseases of childhood seem to rise sharply to a maximum and to decline fairly rapidly after the point of highest incidence. Only diphtheria and scarlet fever continue to show serious mortality rates after the period of childhood.

With the exception of whooping cough, the death rate for these diseases is higher for males than for females during the first five years of life. After the fifth year of life the mortality rates of measles, scarlet fever and diphtheria for the two sexes are not markedly different. For whooping cough the mortality rates are considerably higher for females throughout the entire period of childhood but the percentage of excess female mortality is greatest in the third year of life.

V. ACCIDENTS AND INJURIES.

Accidents and injuries are a significant group of causes of death in childhood. Burns, falls, automobile and other vehicular accidents and injuries, drowning and accidental poisonings constitute the chief single causes of accident mortality at these ages. Burns account for an appreciable percentage of the total mortality from the second to the fifth year of life. Falls play an important part in the deaths between the second and fourth year of life and show much higher mortality rates at each of the ages of childhood among males than among females. The vehicular accidents have their maximum incidence at the age period 5 to 9 years. The automobile is the chief agency in the causation of these deaths.

VI. IMPORTANT INFECTIOUS AND ORGANIC DISEASES OF MISCELLANEOUS ORDER.

There remain a miscellaneous group of diseases which we have not considered under any of the preceding five main groups of causes of death in children. This group includes the organic diseases of the heart, the acute and chronic diseases of the kidneys, acute articular rheumatism, acute endocarditis, diabetes, appendicitis, and tuberculosis, especially tuberculous meningitis.

The organic diseases of the heart first begin to assume prominence in the fourth year of life and increase in frequency up to the age period 10 to 14 years where we record the maximum rate in childhood. Diseases of the kidneys likewise are of significance first in the fourth year of life. The maximum rate for acute nephritis is found between 3 and 4 years, and the minimum between 10 and 14 years. These deaths in many instances follow the acute infectious diseases, scarlet fever chiefly. Bright's disease is of some importance in the second and third quinquennia of childhood. Chronic Bright's disease in childhood is also closely associated with the acute infectious diseases of the earlier ages but the number of deaths continues to be important in the second and third quinquennia. Acute endocarditis and acute articular rheumatism may be considered together, because of the frequent clinical association of the two conditions. We record a significant rate of mortality between ages 5 and 9 years from both of these conditions. Appendicitis is an important cause of mortality beginning with the fourth year of life and increases in incidence throughout childhood.

Tuberculosis is a leading cause of death throughout all the ages of childhood. The rate is highest in the first year of life; it decreases to a minimum in the period 5 to 9 years, and rises thereafter. Tuberculous meningitis is the chief form of tuberculosis in the first ten years of life. Tuberculosis of the lungs shows its minimum rate in the period 5 to 9 years, but beginning with the quinquennium 10 to 14 years, the mortality for tuberculosis of the lungs rises to first importance and continues to hold its place as the leading cause of death for several age periods thereafter.

CONCLUSIONS AND RECOMMENDATIONS.

The following conclusions and recommendations suggest themselves from this analysis of the mortality statistics of childhood.

There is opportunity and need for concentrating the efforts of the public health movement upon the further reduction of mortality in childhood. The work of community health agencies during the past twenty years has shown clearly the large possibilities for life conservation when directed at the preventable causes of infant and child mortality. The reduction of infant mortality has become a definitely established part of the public health programme. Much additional saving can be accomplished by attacking especially the group of diseases which we have included under the heading of prematurity, congenital debility and malformations, etc. The extension of effective prenatal work and the provision of greater facilities for competent obstetrical and nursing aid in childbirth will accomplish very material reductions in mortality from this group of causes which constitute so large an element in the destruction of child life. Practical experience in prenatal work in a number of cities, especially in Boston, Massachusetts, has already demonstrated the exceptional opportunities for the saving of maternal and infant life which await the broadening public health programme in the United States.

The so-called "pre-school" years of childhood have as yet received very little attention from the life conservation movement. Much preventable mortality is in evidence at these ages beyond infancy and under the school years. Sickness and mortality from the acute epidemic infections, and especially from the more serious complications of these diseases, are still in evidence and constitute a challenge to our best efforts for their control. Diphtheria is still a very grave menace to child life at these pre-school years. The extensive development of child welfare clinics, patterned very much after infant welfare stations, seems to be indicated by the facts of our inquiry. While their primary function should be, perhaps, the control of nutritional diseases, the work of such clinics may well result in a reduction of the sickness and mortality rate of the acute epidemic diseases through an increase in the physical resistance of children and by the dissemination of hygienic knowledge to mothers.

The years of school life show comparatively low mortality rates; but even at this period, mortality is capable of still further reduction through additional public health welfare activities for children. There can be more complete coöperation between the medical authorities in schools and those engaged in health conservation work outside the schools. School medical inspection and school nursing are still far from universally available for school children, especially in rural communities and in small cities. Where such medical and nursing service is available to school children, much still remains to be done to make this form of public health service more efficient and in line with practice which has stood the test of experience in the larger centers of population.

Finally, we must seek earnestly to improve our sources of information on child life. Our available records of the number and of the characteristics of American children according to single years of life are indeed faulty. This is especially true for the early ages in childhood, including infancy. Effective health work is conditioned at almost every point by the completeness and reliability of our statistical information. American statisticians, including registrars of vital statistics, and the medical profession generally, should combine all their effective forces to make birth registration once and for all reasonably complete on a nation-wide basis. Similarly we must strive to secure a greater measure of success in the enumeration of the population at the child ages in the Census of 1920. Accurate census returns of the child population of the United States, together with improved birth registration, the extension and refinement of death registration, and the critical statistical analysis of child mortality will place data at our disposal for practical service in the saving of child life, not only in infancy but at the ages of childhood as well.

PROCEEDINGS OF THE 79TH ANNUAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION, PHILADELPHIA, PA.,

December 27–29, 1917.

PROGRAM.

THURSDAY, DECEMBER 27.

10.00 a. m. First Session.

1. The Mortality Rate in Childhood, Louis I. Dublin, Metropolitan Life Insurance Co.
2. Methods of Analyzing Occupational Mortality, Arne Fisher, Prudential Insurance Co.
3. Some Preliminary Results in Industrial Fatigue, Robert E. Chaddock, Columbia University.
4. Infantile Mortality Studies of the Children's Bureau, R. M. Woodbury, U. S. Children's Bureau.

Discussion.

1.00 p. m. Subscription Luncheon. All Associations. Bellevue-Stratford Hotel.

2.30 p. m. Second Session. Business Meeting.

Reports of Officers and Committees.

Election of Officers.

8.00 p. m. Third Session.

Joint Meeting with the American Association for Labor Legislation for Presidential Addresses.

Health and War, Irving Fisher, President, American Association for Labor Legislation.

Statistics in War and Peace, Allyn A. Young, President, American Statistical Association.

10.00 p. m. Reception. All associations.

FRIDAY, DECEMBER 28.

10.00 a. m. Fourth Session.

General topic: The Organization of War Statistical Work in Washington.

1. Statistical Work of the War Trade Board, Walter M. Adriance, Bureau of Research.
2. Statistical Work of the Council of National Defense, Leonard P. Ayres, Director, Division of Statistics.
3. Statistical Work in the Office of the Surgeon General of the Army, Horatio M. Pollock Statistician, New York State Hospital Commission.

4. **Statistical Work of the Federal Trade Commission, L. H. Haney, Economy Board.**

Discussion:

1.00 p. m. Luncheon. University of Pennsylvania.

2.30 p. m. Fifth Session.

General topic: The Vital Statistics of the War.

1. **Army Anthropometric Statistics, Frederick L. Hoffman, Prudential Insurance Co.**
2. **Plans for the Vital Statistics of the War, John S. Fulton, Capt., Medical Section, O. R. C., Washington, D. C.**
3. **The Development of Medical Sanitary Statistics, Walter F. Willcox, Cornell University.**

Discussion: Charles E. Brooks, U. S. Bureau of War Risk Insurance.

8.00 p. m. Sixth Session.

Statistical Units as Standards, Horace Secrist, Northwestern University.

Discussion:

Round Table Discussion of the Census of 1920, Chairman, John Koren. The Discussion will be opened by Edwin W. Kopf, Secretary of the Committee on Relation of 1920 Census to Vital Statistics.

10.00 p. m. Smoker. All associations.

SATURDAY, DECEMBER 29.

10.00 a. m. Seventh Session.

Business Statistics.

1. **Internal and External Statistical Needs of American Business, W. A. Hathaway, American Telephone and Telegraph Co.**

Discussion:

Internal Needs, Roland P. Falkner, Alexander Hamilton Institute, Melvin T. Copeland, Harvard University.

External Needs, Earle Clark, Du Pont de Nemours & Co.

1.00 p. m. Luncheon. Haverford College.

8.00 p. m. Joint Meeting. All associations.

MINUTES OF THE BUSINESS MEETING.

Meeting called to order at 2.30 p. m., December 28, 1917, President Allyn A. Young presiding.

The reading of the minutes of the previous annual meeting was dispensed with, since they had been published in the QUARTERLY PUBLICATIONS of the Association.

Reports were submitted as follows:

SECRETARY'S REPORT.

Mr. President and Members of the Association:

I have the following to report in respect to the condition of the Association:

Membership, December 29, 1916, last annual meeting		699
New members added		72
Deaths during year	10	
Resignations	16	
Dropped	8	
Total deductions		34
Present membership		737
Net gain		38
Besides members we have:		
Subscribers, mostly libraries		227
Domestic Exchanges		40
Foreign Exchanges		117
Total mailing list		1,121

The death of the following members has been reported during the year: James H. Blodgett, Isaac Davenport, Henry Ferguson, Henry Holton, Charles A. Loveland, Manton Marble, George W. Olney, Robert P. Porter, F. W. Whitridge, Walter C. Wright.

Three regular numbers of the Quarterly Publications have been issued, containing an aggregate of 339 pages, and the fourth number—that for December—containing about 70 pages, is now in press. The appearance of this number has been delayed by my removal from Cambridge to Washington, D. C., to enter the service of the United States Government.

Respectfully submitted,

Carroll W. Doten,
Secretary.

On motion it was voted to accept the report of the Secretary and to authorize its publication in the March number of the Quarterly Publications.

TREASURER'S REPORT.

December 22, 1916 to December 19, 1917.

RECEIPTS.

Membership dues	$1,178.18	
Sales and subscriptions	844.02	
Dividend on B. & A.	174.12	
Balance on hand	586.07	
		$2,782.39

EXPENDITURES.

Printing	$1,600.38	
Postage	120.50	
Salaries	325.15	
Expense	8.73	
Balance forward	727.63	
		$2,782.39

ASSETS.

17 Shares Boston & Albany	$2,074.00

S. B. PEARMAIN,
Treasurer.

AUDITOR'S REPORT.

I have audited the accounts of the treasurer of the American Statistical Association, for the year ending December 20, 1917, and counted the securities in his possession. I find the accounts accurately stated and the expenditures properly vouched.

Respectfully submitted,
MARTIN J. SHUGRUE.

AUDITOR'S REPORT.

I have audited the Anniversary Fund accounts of the treasurer of the American Statistical Association for the year ending December 20, 1917 and find that there were no transactions for the year and the balance on hand is correct.

Respectfully submitted,
MARTIN J. SHUGRUE.

On motion it was voted to accept the reports of the treasurer and the auditor and to publish them in the proceedings.

REPORT OF NOMINATING COMMITTEE.

The report of the Nominating Committee, consisting of T. S. Adams, W. Z. Ripley and G. P. Watkins, which had been sent to the members of the Association in accordance with the provisions of the constitution, was presented for action. It was voted to instruct the secretary to cast one ballot for the following persons placed in nomination by the committee: President, Wesley C. Mitchell; Vice-Presidents, Charles F. Gettemy, Joseph A. Hill, Carroll W. Doten; Counsellors, E. Dana Durand, Charles H. Verrill, Fred C. Croxton; Treasurer, S. B. Pearmain; Secretary, Robert E. Chaddock; Librarian, Horace L. Wheeler; Editor, John Koren. The vote was cast as directed and the officers declared elected.

REPORT OF THE LIBRARY COMMITTEE.

The Library Committee, through its chairman, Roger W. Babson, reported on possible plans for the better housing and utilization of the Association Library. The report was accepted and the matter was referred to the Directors with power.

REPORT OF COMMITTEE ON FELLOWS.

The Committee on Fellows announce that the following regular members of the American Statistical Association have been unanimously elected fellows, in accordance with Article V of the constitution: Leonard P. Ayres, R. E. Chaddock, Willford I. King, Max O. Lorenz, A. H. Mobray, Henry L. Moore, N. I. Stone, Frank H. Streightoff, Edward L. Thorndike. The report was submitted by the chairman of the committee, Wesley C. Mitchell, and approved by the Association.

PUBLICATION OF THE MEMORIAL VOLUME.

The discussion of the ways and means for the publication and sale of the Memorial Volume on the History of Statistics in the leading countries of the world, which, through the untiring efforts of the chairman of the Publication Committee, John Koren, is now ready, was taken up. In the discussion it was suggested that a limited edition for members of the

Association at half price be offered, in addition to the regular edition distributed through a book publishing house. The following resolutions were presented and adopted:

Resolved, That the Association refer the question of manner and means of publication of the Memorial Volume to the Directors with power, and,

Resolved, further, That the Board of Directors is hereby authorized to incur liabilities on behalf of the Association, in amount not exceeding $2,000, provided that the incurring of such indebtedness be found necessary to insure the prompt publication of this volume.

The President appointed the following Committee on Resolutions: Joseph A. Hill, Wesley C. Mitchell and William A. Hathaway, to report at a final business session on the following day.

The business meeting adjourned and the regular program of the afternoon was resumed.

A final business session was held at Haverford College, Saturday, December 29, 10.30 a. m., with Vice-President, Joseph A. Hill, presiding.

The matter of corporate membership in the Association, as a special class with appropriate fee for membership, was presented by Willard C. Brinton. After some discussion it was voted that: "It is the sense of this meeting that steps should be immediately taken to secure sufficient funds for the support of the publications of the Association."

A motion was passed, referring to the Board of Directors, with full power, the matter of securing more nearly adequate financial resources for the Association, and directing that Mr. Brinton be invited to sit with the board for this purpose. It was moved by Mr. Koren and unanimously carried, that the constitution and by-laws of the Association be so amended as to permit of the inclusion of corporate members and to provide for their duties, privileges, etc.

RESOLUTIONS.

The Committee on Resolutions, through its chairman, Joseph A. Hill, submitted the following resolutions:

1. WHEREAS Carroll W. Doten has faithfully served the

American Statistical Association as its secretary for 12 years and

WHEREAS, He has felt obliged on account of other duties to decline a renomination to that office,

Be it resolved, That this Association take this occasion to express its grateful appreciation of his services, recognizing that its growth and prosperity are attributable in no small degree to his untiring devotion to its interests and to the tact, courtesy, and efficiency which he has manifested in discharging the duties of his office, and

Be it further resolved, That the newly elected Secretary be instructed to transmit a copy of these resolutions suitably engrossed to Mr. Doten and convey to him the greetings, thanks, and best wishes of the American Statistical Association.

2. *Resolved,* That the Secretary of the American Statistical Association be instructed to convey to the Committee on local arrangements and to the officers of the University of Pennsylvania and of Haverford College our appreciative thanks for the hospitality and entertainment which the members of this Association have enjoyed in connection with these meetings.

3. *Resolved,* That the members of the American Statistical Association through the Secretary extend to Mr. John Koren their thanks for the valuable services he has rendered in connection with the preparation of the Memorial Volume commemorating the 75th anniversary of this Association.

ROBERT E. CHADDOCK,
Acting Secretary.

APPOINTMENT OF COMMITTEES, ASSISTANT SECRETARIES AND ASSOCIATE EDITORS.

At a meeting of the Board of Directors held in New York City, January 11, 1918, the following committees and officers were chosen for the year:

Committee on Federal Statistics: John Koren, Chairman, Thomas S. Adams, Frederick L. Hoffman, N. I. Stone, Allyn A. Young.

Committee on State Statistics: Charles F. Gettemy, Chairman, John B. Andrews, Louise Stevens Bryant, Leonard W. Hatch, Edwin W. Kopf.

Committee on Municipal Statistics: LeGrand Powers, Chairman, Frederick A. Cleveland, Fred C. Croxton, Louis I. Dublin, Edward M. Hartwell.

Committee on Business Statistics: William A. Hathaway, Chairman, Willard C. Brinton, Julius H. Parmelee, Warren M. Persons, Horace Secrist.

Committee on International Statistics: Walter F. Willcox, Chairman, S. L. Andrew, Roger W. Babson, Miles M. Dawson, Irving Fisher.

Committittee on Finance: Harvey S. Chase, Chairman, S. B. Pearmain, Walter E. Weyl.

Committee on Library: Roger W. Babson, Chairman, Edmund E. Day, Edward M. Hartwell.

Nominating Committee: William A. Hathaway, Chairman, Frederick S. Crum, Allyn A. Young.

Auditing Committee: Martin J. Shugrue, Roswell F. Phelps.

Committee on Fellows: Carroll W. Doten, Chairman, term expires 1918; Edward L. Thorndike, term expires 1922; Adna F. Weber, term expires 1921; Frederick L. Hoffman, term expires 1920; E. Dana Durand, term expires 1919.

Associate Editors: Louis I. Dublin, Edmund E. Day, Julius H. Parmelee, Carl J. West.

Assistant Secretaries: Louise Stevens Bryant, Philadelphia, Pa.; Henry J. Harris, Washington, D. C.; Martin J. Shugrue, Boston, Mass.

ROBERT E. CHADDOCK,
Secretary.

IMPORTANT FOR MEMBERS.

NEW PUBLICATION OF NAMES AND ADDRESSES OF MEMBERS OF THE ASSOCIATION, TOGETHER WITH CONSTITUTION AND BY-LAWS.

The Secretary is preparing copy for the publication of a revised list of names and addresses of members, together with the constitution and by-laws. Each member is earnestly requested to make any desired correction in his address, as now recorded on our files, by writing to Robert E. Chaddock, Secretary, 501 Kent Hall, Columbia University, New York City, stating the exact address to which all notices and the publications should be sent in the future. In case there is any doubt about the correctness of your present address in our files, will the members not aid the Secretary by writing *at once? This is particularly important, due to changes brought about by war conditions.*

REVIEWS AND NOTES

Statistics, by William B. Bailey, Ph.D. and John Cummings, Ph.D. The National Social Science Series, A. C. McClurg & Co., Chicago, 1917.

The editor of the National Social Science series in his preface to this new diminutive book on statistics says "The value of a knowledge of statistics grows every day in the fields of business, government and social work. Most of the books devoted to its acquirement are either intricate or too extended. This book has been written with the purpose of avoiding these difficulties."

How simple statistics would be if a good practical working knowledge of them could actually be conveyed to the non-mathematical novice in one hundred and forty seven brief pages of about two hundred and fifty words each. The task set the writers was indeed difficult and one is surprised not that they failed to produce in such brief compass a thorough schematic elementary working handbook but that they succeeded in getting so much that is good into so little, many times even working in suggestions designed to give perfection of detail.

To criticise the book is difficult. It has the merit of its principal defect, brevity. Time and time again one wishes that the writers had gone further, had given us on this point or that the rich fruits of their experience but they must always have been conscious of the limitations of space. One must consider too that the book was not intended as a work for professional statisticians nor as an elementary treatise for students but as an aid for the social workers who venture in the statistical field. To them it will undoubtedly prove profitable and helpful and much of its illustrative material is generally interesting to all who use statistical methods.

The book has nine chapters as follows: I. Importance of Statistics (four pages). II. The Field of Study (three pages). III. Gathering the Raw Material (nine pages). IV. Editing Schedules (nine pages). V. Tabulation (twenty five pages). VI. Ratios (forty one pages). VII. Averages (seventeen pages). VIII. Graphic Representation (twenty two pages) and IX. Correlation (seventeen pages).

LEWIS MERIAM.

Washington, D. C.

SICKNESS SURVEYS OF THE METROPOLITAN LIFE INSURANCE COMPANY.

The agitation for general sickness insurance legislation along lines more or less similar to that providing workmen's compensation insurance to cover industrial accidents has sharply called attention to the need of statistical data with reference to the extent and character of sickness in our various communities, data almost entirely lacking at the present time. Workmen's compensation insurance has demonstrated that a provision for indemnity is necessary to bring out the true extent of disability even when it is such that its symptoms are as objectively apparent as those of industrial accidents. Sickness being a condition of which the symptoms are essentially subjective, it must be evident that it will not be possible to get complete data without a comprehensive insurance system. That, however, is no excuse for not trying to find out all we can about the health conditions of our communities as far as at present revealed.

Recognizing this and having found by test that in their agency organization the industrial life insurance companies have very useful machinery for the collection of social statistics of various kinds, the Metropolitan Life Insurance Company has endeavored to supply something in this field by a series of community sickness surveys under the direction of their third vice-president, Dr. Lee K. Frankel, and their statistician, Dr. Louis I. Dublin. The results of the following surveys have been published:

1. Rochester, N. Y., week of September 13, 1915.
2. Trenton, N. J., October, 1915.
3. North Carolina (sample districts throughout the State), week of April 17, 1916.
4. Boston, Mass., two weeks of July 17 and July 24, 1916.
5. Chelsea Neighborhood (New York City), two weeks beginning April 23, 1917.
6. Principal Cities of Pennsylvania and West Virginia, March, 1917, with a separate study of the results of this survey in Pittsburgh.
7. Kansas City, Mo., two weeks of April 16 and 23, 1917.

The method of procedure was fairly simple and was essentially the same in all the surveys. By reason of the weekly collection of premiums from house to house the agents of the company have established a friendly, almost confidential, relationship with their policyholders who compose a substantial part of the wage-working population of the various communities studied. The agents were supplied with a simple blank on which to record the health condition of each member of every family visited. This blank showed the age, sex and occupation of each member of the family and, where sick the disease or cause of disability, duration, extent of disability, *i. e.*, whether confined to bed, and kind of treatment, *i. e.*, by physician at home, hospital, dispensary, etc. The returns were gathered under the supervision of the district agency heads and the compilations made at the home office.

The data have been carefully and ably analyzed and the results are presented in the form of tables with explanatory text. Among the phases of the sickness problems discussed are: the distribution of sickness by age, sex and condition, *i. e.*, house confinement, ambulant but disabled from work, etc., the distribution of sickness by disease or conditions and duration, age, etc., the nature of care (in this connection community facilities are discussed in some of the reports) and other salient features of the data collected. In short the authors have endeavored from the data before them to give a fair and complete picture of the conditions found. They have not hesitated as they went on to point out weaknesses in the data, though the reports of successive studies indicate an increasing confidence on their part in their results.

In the hands of the careful worker these surveys are most valuable material. Their weaknesses must, however, always be kept in mind. The method is a census method and therefore presents a cross-section at a given instant and not a complete perspective. In comparisons between communities, for example, regard should be had to the influence, if any, of the time of year of the respective surveys or any other temporary factor. From the data presented showing the number of people sick and well, brought within the census, the number of cases of recorded sickness and their duration we can make a reasonable estimate of the average time lost per unit of exposure, *i. e.*, the rate of sickness. It is open to question whether this estimate can be safely taken as equivalent to the sickness rate which would be developed through such complete registration of the same population as would occur under a sickness insurance system. Probably the greatest weakness lies in the fact that the enumerators were not physicians and were not in position to make examinations of any kind and had, perforce, to take the patient's own diagnosis of his case. On this there was no check except where the family was a recipient of the visiting nurse service of the same company.

While we have devoted considerable space to the foregoing weaknesses of the plan, they are inherent in conditions such as all pioneer workers must face. It is to be hoped Messrs. Frankel and Dublin will be permitted to continue these studies and that they will continue, as they have in successive surveys, to bring in new phases of the sickness problem as facilities offer.

A. H. Mowbray.

INTERNATIONAL INSTITUTE OF AGRICULTURE.

In December of 1917 this Institute issued its Year Book of Agricultural Statistics for 1906–1916, which is a survey of ten years of agriculture throughout the world and is described as "without any doubt the most complete work in existence on agricultural statistics as it is the result of the most extensive and, at the same time, the most detailed research yet devoted to this study." Aside from the intrinsic importance of the publications of this Institute, it is interesting to note that it has still remained active during the World War and is probably the only one of the international organisations whose permanent staff comprising representatives of all the belligerent countries has continued at work.

The scope and contents of the Year Book may be gathered from the following excerpts taken from the official circular of the Institute:

Comprising over one thousand pages, the 836 statistical tables are replete with every sort of information upon the subjects considered, thus establishing the volume as one of the highest importance. The number of agricultural products embraced is very large and those of tropical countries have received as much attention as the crops of the temperate zones have secured. In due sequence are furnished all the available data regarding areas cultivated in each country, the total yields realised, and the yields obtained on a given standard of area. Besides all this the Year Book includes the five years' and ten years' averages for the period included, so that readers can ascertain at a glance whether in any particular year cultivation has extended or has been restricted in a given country and whether the results have been favorable or the reverse. . . .

We find that the ascertainable annual yield of wheat throughout the world exceeds a thousand million quintals, and represents at present value, more than two thousand millions sterling; the yield of maize is nearly as large as that of wheat and is worth one thousand millions sterling, while the aggregate value of the six chief cereals (wheat, rye, barley, oats, maize and rice) is not less than six thousand millions sterling, or thirty billions of dollars, yearly.

The yield of potatoes is over fifteen hundred million quintals, and that of sugar beet is more than five hundred million quintals. Every year the world has at disposal a total of one hundred and fifty million quintals of beet and cane sugar, nearly one hundred and fifty million hectolitres of wine, ten million quintals of coffee, more than eight millions of leaf tobacco, nearly one million quintals of hops.

Textile industries account annually for nearly fifty million quintals of cotton, eight millions of flax, seven millions of hemp, while silkworm breeders in Europe and Asia deliver to the trade more than two hundred millions in cocoons. The raw material for vegetable oils comprises yearly throughout the world an aggregate of thirty million quintals of olives, and a similar quantity of linseed, four millions of hempseed, and five millions of rapeseed.

Turning to live stock, we find in the Year Book, for each of the ten years comprised, the numbers of horses, asses, cattle, sheep, pigs, etc., in eighty-two countries taken singly, and afterwards reckoned out as compared with each thousand inhabitants of the country, both at the opening and at the close of the period under review. . . . It appears that in Uruquay there are eight head of cattle to each inhabitant, in Argentina more than four head, in Australia more than two head, and throughout South America about two head per inhabitant, while in the United States and Canada there is one head of cattle per person, and in Europe only one to two persons.

Having given, by means of a large number of tables, the imports and exports of the products previously considered as to yield, and showing the origin and destination of these imports and exports as regards each country, the Year Book takes up the question of consumption, also for each country. It is worth while to note that the consumption of wheat per head of population is extremely large in Australia, in Canada, in France, in Argentine, etc., while it is very limited in Japan, British India, Egypt, Sweden, etc., as the inhabitants of these countries live chiefly upon rice, maize, rye or other articles of food.

The prices of the chief products, on spot and for forward or future delivery form a special chapter, where readers will find all the data for a detailed examination of the marked fluctuations in recent years, inasmuch as weekly quotations are recorded in respect of the chief products. This chapter comprises tables of rates of freight and of exchange.

Then follows a chapter on fertilizers and chemical products employed in agriculture, including the data of production, trade and consumption, with the quotations, for phosphatic, potassic and nitrogenous fertilizers, for sulphur and sulphate of copper. . . .

At the conclusion of the Year Book there is a special chapter where readers can ascertain the authority for each of the data, and are thereby enabled, if they so desire, to consult these authorities and to verify the figures.

The volume is to be obtained at the *Service des abonnements et publications de l'Institut International d'Agriculture, Villa Umberto, Rome, Italy.* Price $2.

NEW SERIES, No. 122. (VOL. XVI.) JUNE, 1918.

QUARTERLY PUBLICATIONS OF THE AMERICAN STATISTICAL ASSOCIATION.

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VII. REVIEWS AND NOTES: An Introduction to Statistical Methods, *J. P. H.*; A Note on King's Article on "The Correlation of Historical Economic Variables and the Misuse of Coefficients in This Connection," *Edmund E. Day*.

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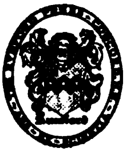

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 122. JUNE, 1918

INTERNAL AND EXTERNAL STATISTICAL NEEDS OF AMERICAN BUSINESS.*

By WILLIAM A. HATHAWAY, *of the American Telephone and Telegraph Company.*

A foreword of explanation seems appropriate. I shall not attempt to define the oft-used term "business statistics," nor to draw a strict line of demarcation between accounting and statistics—leaving the matter of precise definition and fine distinctions to our academic friends. I shall simply describe conditions and suggest some broad, and perhaps bold, ideas for improvement in the existing order of things.

In approaching the subject of the statistical needs of American business, "business statistics" seemed to divide logically into two categories, internal and external: "*internal*" comprising the statistics compiled by private enterprises for their own direct benefit, *i. e.*, the analysis of a company's own business and data related thereto; and "*external*" comprising statistics compiled by others, such as (1) business indices and barometers, and (2) governmental statistics for general consumption.

INTERNAL NEEDS

Extent of private statistical work:

Under internal needs let us first look at the extent of private statistical work.

It is difficult to determine, even roughly, the amount and character of statistical work done by business concerns, chiefly for two reasons: *first*, it is so varied and often so closely related to regular accounting work, and *second*, no community of interests has existed among those engaged in such work. But we

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* Paper read at the seventy-ninth Annual Meeting of the American Statistical Association.

know that there are thousands of large and small business concerns, including public utility corporations, manufacturing and mining industries, wholesale and retail mercantile firms, and financial institutions, which are engaged in statistical work of more or less importance. The most common and best known types of such work are cost accounting studies and analyses of production and sales, since these were the first statistical offshoots from regular accounting work. Also, we should not forget the statistical compilations of trade journals and business associations, and those of private commercial agencies, such as Bradstreet, Dun, Babson, Brookmire, etc.

Statistical data appearing in trade journals and financial papers have grown tremendously in the past few years. A recent survey found over 300 different topics or sets of figures—appearing in over twice as many publications—the same data often appearing in a half-dozen papers or so. Indeed, we only need look at our daily newspapers to realize that the American people are relying more and more on facts as bases for opinions and arguments. Possibly we accasionally attempt to prove too much rather than too little by statistics, especially since much of the product is by no means scientifically correct.

Causes of rapid development of private statistical work:

Three factors appear to have been largely responsible for the rapid development of private statistical work during the last 10 or 15 years:

1. The evolution from small to large business undertakings (industrial combinations).
2. The increase in legislation affecting business, especially public utilities.
3. Progress in the manufacture of mechanical labor-saving devices for accounting and statistical work.

The centralization of administrative policy and control in many lines of industry has made necessary more data and derivative figures than mere corporate accounting affords.

The creation of federal, state and municipal regulatory and investigating bodies has forced statistical development on a large scale among public utility and industrial concerns. Questions involving the amount and character of business, the cost of production, prices or charges for service, etc., must be studied through the medium of statistics by such investigating and regulatory bodies as well as by the owners and managers. Compensation commissions also need and require much information from the industries within their jurisdiction; and workmen's compensation laws and other employees' disability benefit plans have made it necessary for all large employers of labor to have a knowledge of, and often to undertake their own, statistical work. In short, the requirements now laid on business by governmental bodies can be adequately met only when full statistical records are kept currently.

Mechanical devices have made it possible for private concerns to make statistical compilations and investigations which were formerly prohibitive from the standpoint both of cost and of time.

That business throughout the country still needs to know more about itself is evidenced by a recent statement by the Chairman of the U. S. Federal Trade Commission, who said: "A large proportion of the business men of the country do not know their costs; nine out of ten establishments making several products cannot separate the sales; of 60,000 large corporations, one-half do not charge off a single penny for depreciation." A member of one of the committees of the Council of National Defense stated the other day that if American business had kept better records, the work of the Council would have been greatly simplified and accelerated.

Future needs:

That, in the future, statistical requirements will increase rather than diminish seems certain. The past decade has witnessed many changes in the political, social and industrial life of the nation; but the next few years promise even greater, perhaps revolutionary changes. Statistics will be required as never before by those in high places, both in business and in governmental affairs, as a guide to the right solution of the questions of the day. The statistician will be called upon to furnish these data properly analyzed and correlated.

At the present time much of the statistical work of private corporations is being done by poorly equipped persons. In many cases the work is done by persons drafted from the accounting and clerical forces; and in some cases the work is carried on merely in conjunction with bookkeeping and accounting work. There are only a few *experienced* men, and practically no *technically* trained workers, now available. The demand for properly trained as well as experienced men to do accurate, scientific work is far greater than the supply. Hardly a month passes without a request coming to our office for a bright young man who can make statistical analyses and illustrate the results graphically. We are also constantly besieged by men and women, young and old, begging assistance on how to conduct statistical investigations which have been called for by their employers. These persons usually have no conception of the theory or method of statistical procedure, and are apt to be poorly equipped mathematically.

The lack of properly trained men is chiefly the result of the lack of adequate training facilities in our educational institutions. I believe I am safe in saying that nowhere in this country is there offered a thoroughly comprehensive course in the theory and method of statistics *coupled with practical application.* The main deficiency in existing courses lies in the inability to teach the application of theory and method by actual laboratory work on real problems and investigations, especially problems and investigations relating to business. Although admitting that the science *is* difficult to teach, we cannot concede that it is impossible to have more effective instruction in the future, *provided* the experience of those now engaged in private statistical work is utilized. Here let me suggest that it would be a good plan for our academic friends to alternate their teaching semesters with actual work in both the private and governmental statistical fields.

Is it not a proper function of the American Statistical Association to foster and promote higher education in statistics? Indeed, I am not so sure but that it would be a good plan to introduce elementary courses in statistics and graphics in the primary and secondary grades of our public school systems. Why should there not be a standing committee in the Association whose duty would be to take the initiative in assisting colleges and universities to establish up-to-date courses in statistics with especial reference to business needs, and to encourage and supervise the compilation of a sufficient number of text books to adequately cover the field. At present we have only one or two statistical text books, and only one treatise on graphics, by American authors; these are good, but elementary. We are in sore straits for text books that will contribute something towards standardization of tabular and graphic presentations in both business and governmental work.

Although it has come into pretty general use, the graphic method of presenting facts is still only in its infancy and has unlimited possibilities, especially for analysis of corporation accounts. Much of our present graphic product is poor in technique. I have in mind a current weekly periodical, devoted to business and economics, which publishes charts that are without sufficient titles and keys to be self-explanatory and that have to be interpreted by text which is often on another page. Again, many graphics are so complex that they have to be *studied* before their meaning is clear. For most purposes, a chart that has to be studied has no reason for existence.

About a year ago, a committee on standard rules for graphic construction made a preliminary report concerning some 17 basic rules.* These rules were excellent so far as they went; but the report was only a beginning, and the committee seems to have languished and died like most voluntary efforts. Irving Fisher's booklet, "The 'ratio' chart for plotting statistics," gave us some valuable hints on the use of logarithmic scales. Field (Chicago) has also recently made a valuable contribution to the same subject.† Logarithmic scales are too little understood in the business world, and these two works have helped to show us their usefulness. Such contributions are, however, necessarily limited. Private individuals have neither the time nor the resources required adequately to cover the field.

The American Statistical Association has in the past confined its deliberations and publications almost exclusively to the academic and governmental field of statistical activities. May I suggest that it is time for the Association to awaken to a fuller realization of the fact that the compilation and interpretation of facts now attends, or should attend, all important business undertakings, and that the field of statistical accomplishment no longer lies exclusively in institutions of learning and governmental bureaus. In other words, business is trying to put the theories of the academicians into actual practice, but is not getting the assistance it needs from them in return. Indeed, some of the most helpful and illuminating current thought on the science appears not in the American Statistical Association publications, but in the publications of other scientific associations.

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* The committee was composed of representatives from seventeen scientific societies. The preliminary report can be purchased from the American Society of Mechanical Engineers, 29 West 39th Street, New York City.

† See The Journal of Political Economy, October, 1917.

EXTERNAL NEEDS

Before considering the needs that lie entirely outside of the field of private activities, I want to call attention to a phase of business statistical work quite different from that which I have already mentioned. It is this: Industrial and commercial enterprises are being vitally affected by the results of statistical studies, inquiries and investigations made by government bureaus and commissions—and by private organizations and individuals—of varying degrees of competence.

Business interests have, for the most part, been too prone to accept meekly the statistical results by which they have been judged; and too often they have replied in non-statistical terms or by general denials. This situation is wrong. Business should take part in these studies and results, not with a view to concealing or distorting facts, but in a spirit of coöperation and mutual helpfulness and seeking after the truth. We must remember that statistics have a large potential value in shaping public opinion, and that this is true also if the statistics are faulty but are not refuted. Agitators and enthusiasts are constantly appearing before legislative bodies with extravagant claims and ridiculous data. In these cases it is the duty of the interest affected to meet such misstatements with a presentation of the *facts*. But this cannot be done unless business secure competent statisticians, and where are they to be found in sufficient numbers?

Let us now look at some external statistical needs of business from the standpoint of *existing material*, and *additional data and treatment needed*, remembering that we have already divided this part of the discussion into two main categories: (1) statistics relating purely to business, and (2) governmental statistics for general consumption. The speaker may perhaps be excused if he indulges in criticism of governmental statistical work because of his former association therewith.

Business—existing material:

Only a few years ago one or two sets of figures, *e. g.*, railroad earnings or bank clearings, were considered sufficient to indicate the condition and trend of business in general. As commercial and industrial life expanded and became more complex, both at home and abroad, however, it became necessary to consider more factors to secure the desired present and future vision; and then we began to have trouble in comparing one factor with another and in giving each its proper weight in our mental calculations. We find that we need a *composite* result, but here we are confronted with many difficulties. What factors or items shall be selected? What method of combining and weighting, if any, shall be used? What base shall we take against which to measure changes? What shall be done with seasonal and cyclical trends? Before we have gone far into the consideration of these questions, we discover the phenomenon of business cycles and find the solution of our problem still more difficult.

Babson's and Brookmire's statistical charts and services have attempted to solve these problems, and Mitchell has given us some wonderfully illuminating data in his study on business cycles. While in no way depreciating the efforts of Babson, Brookmire, or Mitchell—for they have done pioneer work—nevertheless, we are forced to the conclusion that the results given us rest largely on a basis of *judgment* of the compilers, and that these perplexing problems can only be solved by additional research and analyses.

Babson and Brookmire differ as to the factors selected, method of combining and theory. Babson does not eliminate cyclical trend, but computes and shows it as the XY line in his composite plot. It is only fair to state, however, that Babson has recently been issuing a series of charts that does eliminate growth. Brookmire, on the other hand, computes and eliminates the cyclical trend and shows a horizontal "normal" line OP. Who shall say which is right?

Thanks to Persons (Harvard) and King (West Va.), we now have some light on some of these matters. In a most admirable study, Persons tested, by means of the Pearsonian coefficient of correlation, the significance of 25 items or series generally used as business indices, and found nine whose fluctuations are *concurrent* and which are therefore proper to use in constructing a business barometer, and five whose fluctuations *precede* those of the nine and which are therefore useful in forecasting business changes.[*] It should be noted here that Persons' study was based on *annual* data, and, as the author states, further investigation based on quarterly and monthly observations is necessary to reach final conclusions.

Similarly King tested, by the same method, some of Mitchell's conclusions regarding cyclical movements of certain price series. His analysis supports Mitchell in some conclusions, but differs in others.[†] Here again *annual* data are shown not to be sufficient for the final and conclusive test to which Mitchell and King have but pointed the way.

Business—additional data and treatment needed:

It appears that the compilations of basic data, especially data used as business indices, are fairly ample;[‡] and, furthermore, there is no evidence but that these compilations, in general, are sufficiently well made to serve all practical purposes. But American business interests, and the government as well, need a properly constructed, comprehensive business barometer, or a series of barometers, and a business forecast, if it is possible to construct them. Whether the construction of such a barometer and forecast is a proper government function, or is one that should be left to private initiative, is a question that can not be intelligently answered until we have further light on the subject. And it is here that the government can do a constructive piece of work for American business. The vast amount of mathematical and research work necessary before we can reach a proper solution of the difficulties that attend these statistical problems is too much for private enterprise to undertake at present. The government ought, at least, to continue the studies of Persons, King and Mitchell.

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[*] The nine concurrent items are—railroad gross receipts, railroad net receipts, coal production, exports, imports, pig iron production, price of pig iron, immigration, and wholesale prices. The five preceding items are—sales on New York Stock Exchange, price of same, bank clearings (corrected), new railroad mileage, and business failures. See The American Economic Review, December, 1916.

[†] See The Quarterly Journal of Economics, August, 1917.

[‡] At least one possible exception to the sufficiency of available data should be noted: *i. e.*, U. S. Post Office receipts. They were published for a selected number of large cities up to a few years ago. Their publication should be resumed.

The idea of a governmental index of this kind is not a new one. About 1907, the French government appointed a commission, composed of governmental officials, bankers, statisticians and economists, to study the possibility of constructing one or more general business indices. The commission reported that certain factors or series could be used; but a composite business barometer was not constructed.[*]

Right in line with work of this character, Dr. Hoffman has recently proposed weekly or monthly government index numbers of national health and social well-being, including index numbers of—

The general urban death rate
The sickness rate in industry
The accident rate in industry
Number of arrests in large cities
City expenditures for poor relief
Ratio of unemployment.

He also suggested that possibly all these index numbers could be combined into one general index for the entire country,[†] and pointed out that comparatively few new data would need to be collected. The speaker heartily seconds Dr. Hoffman's suggestion. It is this kind of work, especially the accident and sickness rates in industry and the unemployment ratios, that the business interests of the country need—something concrete and up-to-date.[‡]

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[*] Cf. Persons' article in The American Economic Review, December, 1916.

[†] See Economic World, July 7, 1917.

[‡] Evidently as an outgrowth of Dr. Hoffman's suggestion, the Bureau of the Census has recently begun the publication of a Weekly Health Index. It is a step in the right direction, but the results thus far are not all that could be desired.

Governmental—existing material:

The amount of data collected annually, quinquennially, and decennially by our government is enormous and covers practically the entire range of human activities, *except* the field of wholesale and retail trade, and the distribution of the wealth and income of our people. Indeed, this country takes first rank among the nations of the world in the amount and the frequency of statistics gathered and published. To one familiar with governmental statistical activities, their bulk is appalling, and one is prompted to ask, Is it all necessary and serving a useful purpose? I am inclined to believe that it is not so much a question of over production as one of poor production, poor in the sense of lacking coördination, correlation and interpretation. In other words, it is not sufficiently digested before given to the public.

Governmental—additional data and treatment needed:

It would hardly seem that we could possibly need any more government statistics; but we do. We need *annual* production figures for both manufactures and agriculture. Our five-year censuses of manufactures no longer suffice to show the rapid industrial changes which are taking place in this country. If this present world war terminates by 1920 and if conditions are then restored to anywhere near a normal or pre-war basis, the tremendous expansion and change in the complexion of American industries due to the war will be completely lost in the federal statistics. We also need better industry classifications, details on kind and quantity for more products, and classified wage schedules of industrial workers.

The annual farm production estimates of the Department of Agriculture serve in a measure to fill the gap between the ten-year agricultural Census enumerations; but either these estimates should be further improved, or else a limited annual production census should be taken by the Census Bureau. Government statistical work, in general, has been conducted too much from the standpoint of history. We need *current* facts to guide administrative and legislative policies in affairs, both public and private.

But even more important than additional data is the need for coördination of present governmental statistical work and for better analysis and correlation of the results of this work. The following will illustrate:

(a) We have historical statistics on population and agriculture, but where is there a comprehensive study correlating the two? Present world conditions have served to revive interest in the Malthusian theory, but do we yet know the facts?

(b) The Census gives us an estimate of the wealth of the country every 10 years, but where, *except* in Wilford I. King's recent work, is there any attempt at scientific analysis of the sources and distribution of wealth, and the amount of the national income and savings therefrom?*

(c) The Bureau of Labor Statistics publishes data on relative prices and wages, but where is there a composite index of the increased cost of living in various localities and occupations, *except* a few general studies like Rubinow's? This is a vital question in present wage controversies, but we have practically no conclusive data.

(d) The Census publishes figures on domestic production by industries, and another bureau the statistics of our foreign commerce; but, on account of the differences in classification, etc., it is not possible to compare one with the other to any great extent. Again, where are there any official figures on the effect of higher prices on the money aggregate by which we measure our foreign and domestic trade? What about the actual volume?

(e) The Department of Agriculture recently gave us an annual estimate of $21,000,000,000 of farm products, but did it tell us that the total includes billions of duplications due to the feeding of crops to live stock, or an estimate of the amount of this duplication?

(f) Why do we not have a complete monthly government index, or catalog, of the mass of material which the various departments and bureaus gather, compile and publish? Much valuable information never reaches business concerns because they do not know that it exists.

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* During the past few months we have witnessed the efforts of government officials and others to prove that our national resources are ample to meet huge war costs, and practically the only figures available were King's and how they have been misinterpreted and misused!. We glibly quote $250,000,000,000 of wealth, but how much is fixed and how much is liquid? It is well to remember that fixed capital is of use to the government only as a going concern.

(g) Congress has appropriated $20,000,000,000 for the conduct of war, but what governmental agency has compiled a comprehensive budget showing sources of income, character of expenditures, methods of financing, etc.? The only intelligent statements have come from some of the New York City financial institutions.

(h) Upon the vital question of the division of income between capital and labor, where have we any helpful official studies of a late date?

These are only a few examples of where and how our present governmental activities fall short of giving American business the statistical information it needs and *pays for;* they could be extended *ad libitum.*

Further proof of the lack of coördination and proper analysis of our official statistics is found in the administrative conduct of the present war, so far as the determination of facts upon which to base executive action and policy is concerned. One would naturally suppose that the newly created war bodies, such as the Shipping Board, the Food and Fuel Administrations, the Export and Priority Boards, the Council of National Defense, etc., would turn to existing statistical bureaus for most, if not all, of their information. Apparently they have not done so to any great extent; on the contrary, they have felt it necessary to largely conduct their own investigations and studies. The speaker was surprised to learn, upon a recent visit to Washington, that the Census Bureau (the largest statistical office in the world) is not now, nor has it been, engaged to any extent on war work, but is pursuing the even tenor of its ways on peace-time investigations which might well be suspended so that the entire staff of the Bureau could be released for use in conducting war investigations and preparing war compilations.*

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* It is recognised that much of the war work is specialised and should be done in the respective organisations or close thereto. But the personnel and equipment of the Census Bureau should be utilised somehow, even if it be necessary to temporarily transfer some of its units to war offices. In this connection, it is suggested that 5,000 employees might be found in the various departments at Washington who could be transferred to direct war work for which there is a dearth of workers.

Is not this condition a sad commentary on the insufficiency of the statistical product of our permanent bureaus in Washington? Does it not indicate that they have failed to measure up to the demand for current concise facts, or, at least are lacking in vision and initiative?

We have been spending millions of dollars annually for governmental statistics which have inadequately met the current needs of the business interests of the country and have failed the government itself in a war emergency. What is the remedy? How can the mass of statistical data collected by the government be vitalized and made more useful? The only answer seems to be the establishment of an *independent* government bureau of statistical administration, research and analysis, which would not be a part of any existing government department or statistical office. Such a bureau should be provided with the best expert statisticians and economists the country affords. Their tenure of office should be so limited as to keep the bureau alive and progressive, and their appointments arranged to insure continuity of work. The commercial, industrial and labor interests of the country might well be represented also. Indeed, I suggest that nominations for the commissioners in such a bureau be made by popular vote at the annual meetings of the American Statistical and Economic Associations, and that the U. S. Chamber of Commerce and the American Federation of Labor, respectively, make nominations for the representatives of commerce, industry and labor. Let the scope of the work of the bureau be worthy of the best thought and experience of the men most distinguished in their respective callings, so that it would be a crowning achievement and highest honor to have been chosen to direct, or to participate in, the work. Moreover, in addition to the functions already indicated, such a bureau should be a central clearing house on all official statistical matters, and should exercise a stimulating and supervisory oversight on the work of the various departmental bureaus. It should also promote international statistical studies and comparisons—a function that will be especially important during the reconstruction period following the war.[*] Congress needs to be supplied with a large volume of convincing facts; both old and new war bureaus and boards must have adequate statistical information for the conduct of their work; and business of the country is relying more and more on specialized and general statistics in this period of war adjustments. There is plenty of work for the new bureau to do.

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[*] "The Office of National and International Statistics" might be an appropriate name for the new bureau.

To the intelligent and liberal use of statistics, must be credited much of England's remarkable success in creating her wonderful war machine and in organizing the resources of the nation back of it. Our English cousins have perhaps a keener appreciation of the value of statistics, especially in war work, than have we Americans.*

Now would seem to be a propitious time to secure the necessary legislative action for the establishment of the proposed new statistical bureau. I believe that if the scientific bodies gathered in this city this week were to get behind such a project and were to join with the Chamber of Commerce of the United States, the creation of the bureau could be accomplished during the present session of Congress. Here is another opportunity for the American Statistical Association to do a constructive piece of work, and take the leadership in advancing statistical science in this country. Will it seize it, or will it continue to be largely a debating and mutual admiration society?

Recapitulation:

(1) *Internally* American business needs more and better equipped men to do its statistical work, and suggests that the American Statistical Association foster and promote higher education in statistics and encourage the publication of adequate text books.

(2) *Externally* American business needs, principally, three things:

(a) Further studies, by the government, on the construction of business barometers and forecasts and the establishment of certain indices relating to social well-being.

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* Sir Eric Geddes has a penchant for statistics. In a recent interview he said: "I statistize everything. Knowledge is power and statistics are the throttle valves of every business. But don't let statistics master you—use them."

(b) Annual official production figures on manufactures and agriculture; a revision of industry classifications; details of kind and quantity for more products; and classified wage schedules for industrial workers.

(c) Better coördination of existing government statistical work, and correlation and scientific analysis of the material now collected and published.

Business also urges the creation of an *independent* federal bureau, manned by the best experts the country affords, to the end that government statistics may be vitalized and made more useful, the establishment of this bureau to be accomplished by the American Statistical Association joining with other scientific bodies in securing the necessary legislation during this session of Congress.

President Wilson has truly said, "Facts are our masters now." But, gentlemen of this Association, are we masters of the facts? I fear we have far, very far to go before we can answer in the affirmative.

A PHASE OF THE EXTERNAL STATISTICAL NEEDS OF AMERICAN BUSINESS.*

By Earle Clark

There is an increasing demand on the part of business executives for statistics concerning general economic, social, and political conditions which affect the interests of business organizations. Statistics of this kind, used for business purposes, may be described as "external business statistics," as distinguished from "internal business statistics," which consist in a quantitative analysis of the accounts and affairs of an individual commercial or industrial concern.

For statistics relating to general conditions, the business world is largely dependent upon the official statisticians of the federal and state governments. One urgent statistical need of American business consists in an extension of the work done by governmental agencies which is useful to business. This need has been described and emphasized by Mr. William A. Hathaway, in a paper appearing in the current number of this Quarterly.

It is the purpose of the present paper to show that private business interests should take part in some statistical activities which have heretofore been left to the statisticians of governmental bureaus and commissions. The need for this work is due to the connection which exists between the statistical activities of the government and the welfare of business organizations. The work to be done consists, in brief, in the scrutiny, verification, and, in some instances, amplification of official statistics by the statisticians of business concerns.

I. A GOVERNMENT BUREAU OF STATISTICAL ADMINISTRATION, RESEARCH, AND ANALYSIS.

Because of its evident bearing upon the production and interpretation of statistics affecting business interests, a suggestion made by Mr. Hathaway, in the paper referred to above, will be commented upon at the beginning of the present discussion. Mr. Hathaway recommends, as a means of serving an urgent statistical need of business, the creation of a federal bureau to be charged with supervising, supplementing, and interpreting official statistics. There are obstacles to the creation of such a bureau, but they are not insuperable, and the work of such an organization should be of value, not only to private business interests, but to the entire public. It may be well to give examples of the tasks that such a bureau should assume, and also to mention a danger to be avoided.

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* Paper read at the seventy-ninth Annual Meeting of the American Statistical Association.

Examples of Tasks to Be Assumed.—One of the first functions to be exercised by the proposed organization should be that of harmonizing the statistical work of the different government bureaus and commissions. The United States has a tariff system which was created in the interest of our manufacturing industries. Even when the tariff schedules are revised with emphasis on their revenue producing features, the interests of industry must be, and are, considered. We have statistics of imports and of revenues, and also statistics of manufactures, but the two groups of statistics are wholly independent and, for the most part, cannot be reconciled. It may not be possible to take a census of manufactures with all the detail as to products adopted in a tariff schedule, but a bureau of the kind Mr. Hathaway recommends should seek to have the broader groupings of one mass of data made comparable with the groupings of the other.

Another task for a bureau of research is the elimination of duplication in gathering statistics. Anyone who has collected information upon government schedules has probably had the experience of being assured by a manufacturer that he is ready to give the facts asked for, but that he gave these same facts to another representative of the government about a month before, and similar facts to a third representative within the half year.

The illustrations just cited are not novel ones; they relate to needs generally recognized by statisticians. To emphasize them and repeat them may assist in bringing about an improvement in conditions.

A Danger to Be Provided Against.—In creating a bureau for the coördination and interpretation of official statistics, it would be necessary to provide against a development that might seriously impair its usefulness. Such an organization must possess, if it is to be efficient, large statistical powers; it must be able to commandeer data from a number of sources; and its statisticians must have free hand in selecting the methods to be used in assembling and interpreting statistics. The conclusions of the bureau would appear to have behind them all the authority of the government. By reason of this concentration of power and authority it is conceivable that some of the findings of the bureau might be accepted for more than they were really worth. To say this is not to reflect upon the quality of the work that would be done, nor the qualifications of the statisticians who would do it. But no statistician is infallible. That the statisticians would seek to exaggerate the importance of their results is not probable, but it is possible that the public would be inclined to accept findings of the bureau at their face value, without much inquiry as to the facts and reasoning on which they were based.

The private agencies which endeavor to interpret economic statistics presumably make mistakes, but business is not dependent on the output of any one organization. The results of one agency can be checked by those of another. If faith is lost in one organization, it can be discarded for others. And when different organizations, proceeding independently, reach the same conclusions, these conclusions have additional weight. In the interpretation of economic statistics, competition is desirable.

The remedy for the danger referred to consists in the presentation, by the interpreting bureau, of its original data, together with a full and clear statement as to the methods by which conclusions are reached. If such statements were made, methods and results could be checked, and would be checked, by the representatives of private business enterprises.

II. A NEW FIELD FOR BUSINESS STATISTICS.

Consideration of the statistical work on the part of business organizations that is made necessary or expedient by the statistical activities of the Government involves: (1) a statement of the basis of the need for work of this kind, (2) a broad classification of the work according to both (a) the processes employed and (b) methods of presentation, and (3) a consideration of the relation of the work to the interests of the public.

Basis of Need for Work.—The need for statistical activity of the type mentioned has its source in the effects of governmental authority upon business enterprises. In times of war, government control is more evident than usual; price fixing, for example, is a relatively new extension of governmental power; but at all times the influence of what is done by the state and federal authorities greatly exceeds what would commonly be described as government regulation of business. Thus, the enactment of a tariff law is not, in the accepted sense, government regulation, but such a law may result in a marked change in the conditions under which industry works. Business interests are affected, also, by revenue laws and by legislation adopted in the interest of wage earners and of the public, as, for example, laws fixing the hours of labor, laws regulating the employment of women and minors, minimum wage laws, factory inspection laws, and laws providing for the inspection of manufactured products. Railway rate making is a form of government activity which affects, not only the railroads, but all phases of business life.

Legislation of this kind is based, in increasing measure, upon the results of statistical inquiries, studies, and investigations, carried on by commissions, bureaus, councils, public and private, of varying statistical competency. Our statistical libraries largely consist of reports of investigations which have been authorized in order that they might serve as the basis for legislation, and which have in many cases been fruitful of legislative results. The list includes, for example, the reports of state and federal commissions on industrial relations, the minimum wage, immigration, etc. Moreover, in formulating and debating laws, reference is constantly made to bodies of existing data, such as the reports of the Bureau of the Census and other permanent government offices. Revenue laws and tariff laws are enacted with reference to statistics gathered and compiled for the purpose, or drawn from existing sources.

It follows that the interests of business are directly affected by the quality and amount of the statistical work done by the different government offices. Naturally, this work shows wide differences. Some of it represents the high water mark of our statistical accomplishment, much is of good average quality, and some is unintelligent, misleading, unenlightening. Again, the output of a statistical office does not always exhaust the subject to which it relates. Lack of comprehensiveness in data used as the foundation of legislation affecting business, and the possible presence of imperfections, impose a burden of statistical work upon business interests.

In the past business concerns have, in general, accepted passively the statistical results by which they have been judged, or have replied in irrelevant, non-statistical terms, as by general denials and denunciations. They have been accused of attempting to affect legislation by the exercise of political influence. Moreover, in hearings before government commissions, congressional committees, etc. in which statistics have been involved, corporations have usually left the presentation of their interests in the hands of their legal departments, with the result that pertinent, valid, and reasonably conclusive statistical arguments have sometimes been subordinated to attempts to confuse or discredit witnesses, and generally to "befuddle" the issue.

The policy, or lack of policy, just described has no doubt been due to a blind faith in the government as a source of statistical information, a faith sustained by the high quality of some of the work of the Bureau of the Census, the Bureau of Labor Statistics, and other offices. The attitude of business has been that the government is doing the work, and that duplication is superfluous. This policy is not followed with respect to other types of governmental activity. An inquiry as to whether or not a given combination of interests involved a violation of the anti-trust law would not be left wholly to the office of the Attorney General. The problem would be studied with care by the lawyers of the companies affected. The statistical offices of the government are no more infallible than its legal offices.

In the future, business concerns will find it to their advantage to retain the services of statisticians who will follow up the statistical activities of governmental organizations which have a bearing, direct or indirect, upon business interests, and will initiate inquiries in the business field with a view to influencing public opinion and action. This aspect of the statistical activity of business organizations will consist in separating the statistical wheat from the chaff, and in doing every thing possible to augment the supply of wheat. Some of the work will be carried on by single corporations, and some by associations of corporations having a common interest.

Already there has been some development of activity in this field. An example is the work of the Bureau of Railway Economics which "was organized in 1910, for the purpose of studying scientifically the various problems with which the railways are concerned and preparing studies and statistical compilations for the use of the railways and for general distribution." Statistical data are compiled, also, by trade associations, chambers of commerce, etc., but the gathering of statistics by such organizations is usually subordinate to other activities, and the results are seldom brought into direct relation with those obtained by the government. The Iron and Steel Institute is an example of an association collecting and compiling statistics.

Classification of Work: Procedure.—Classified according to procedure, the work to be done will include: (1) a careful scrutiny of statistics affecting business compiled by government agencies, (2) the making of studies in the business field parallel to those made by the government, (3) the utilization of existing statistics concerning questions at issue, and (4) the searching of the entire statistical field for data bearing on the relation between business and the government.

To say that government reports should be scrutinized and verified is not a reflection upon the competency of the persons preparing them. Any important statistical inquiry, as, for example, the determination of the trend of prices, involves a multitude of technical decisions. Upon many of these matters there may be differences of professional opinion.

The scrutiny of a statistical report means much more than a checking of the arithmetic, though this is sometimes useful; it involves a review of sources and of methods, including the collection of information, tabulation, interpretation, and presentation. Unanticipated results may sometimes be obtained by taking the raw material of a study and treating it by methods differing from those employed by the official statisticians.

It is well to emphasize the value of this phase of the activity of private interests. Inaccuracy and inconclusiveness are among the most serious faults of statistical work. It seems that too many people are compiling and interpreting statistics as compared with the number who are scrutinizing, testing, verifying, and when necessary condemning the output. If a given statistical product is sufficiently voluminous, laborious, and intricate, it is quite likely to be taken at its face value because there is no one whose business it is to work it through or think it through in a critical way. Verifying a report intelligently and conscientiously may require as much labor as was contributed by the person who prepared it.

Scrutinizing and reviewing reports will be, perhaps, the most significant and useful external activity of business statistical offices. But the work of these offices will not stop with this. Inquiries bearing upon business problems can often be initiated at the same time by the government and by the interests directly affected; an inquiry by a business concern may sometimes anticipate that by the government and, if the inquiry is careful and the presentation is full and clear, may do away with the necessity for an official investigation.

Classification of Work: Presentation.—With respect to presentation, the statistical activity that is being considered may be expected to take at least three forms, as follows: (1) reports to the officers of a company, for their guidance and information regarding a given situation, in order that they may decide what policies are desirable and practicable, (2) statements to be published in newspapers or periodicals, as contributions or as advertisements, for the information of the public and the shaping of opinion, and (3) reports or statements direct to governmental bodies, in the form of testimony or memoranda.

In all three types of presentation, but especially in the first two, the graphical method will be used.

In presenting statistics to governmental boards or committees, in the form of testimony, there will be occasion for cooperation with the legal departments of corporations. To some statisticians and accountants it may appear that the intervention of lawyers in such cases is unnecessary, but it must be borne in mind that the machinery of governmental hearings is organized upon a legalistic basis, that many of the members of committees and commissions are themselves lawyers, and that some of the interests involved are usually represented by legal talent. This being so, it is probably inadvisable to proceed without legal aid, though the statistician will supply the subject matter, and should be able to bring about modifications in the way in which it is presented.

Effect of Work on Interesis of Public.—The statistical work described will benefit the private enterprises by which it is supported; it will also contribute to the public welfare. It will benefit the public in two ways: first, by helping to establish the truth concerning questions of importance, and, second, by contributing to the advancement of statistical science.

The work will be competitive—in a sense, controversial. This fact will make for reliable results. The certainty that the product of a government office will be subjected to thorough examination will constitute a powerful incentive to painstaking and intelligent workmanship. The statisticians of business concerns, in turn, will realize that their findings will be carefully scrutinized. Much of their output will be critical, and the critic, above all others, must be sure of his facts and of his processes.

In seeking to establish the truth as to questions at issue, statisticians of business organizations will apply and test statistical methods. New devices and procedures will be developed, and these will be of value not only in the business field but in all the sciences.

THE SCOPE OF BUSINESS STATISTICS.*

By Roland P. Falkner, *Alexander Hamilton Institute.*

Books and articles upon business topics multiply in these days with the rapidity of the traditional rabbit. Among them we frequently encounter the phrase "business statistics." Is it not time that those who claim to be statisticians should welcome the new comer and find a place for him at the family table? In doing so we must not be guided by purely theoretical criteria as to what constitutes statistics, but must consider whether what passes under the name of "business statistics" really serves some useful purpose. If it does so, it will survive whether it is formally recognized or not.

It must I think be acknowledged that the term "business statistics" is not, as many seem to think, self-explanatory. It is true that it has been used rather loosely to designate any statistics which are of interest to business. It has been made to cover the interest of business men in general statistics, or the utilization of general statistics for business purposes. It is pointed out that statistics of manufactures, of foreign trade, of railways, of banks, prices, wages, stocks and a host of others are not only the fruit of business activities but that their conclusions may be helpful in the conduct of business enterprises.

This is certainly true and points out manifold relations between statistical investigations and business undertakings that the purely academic statistician often overlooks. But on the other hand it does not justify the calling of such statistics, "business statistics." We have long known them under the name of "economic statistics," and knowledge is not increased by calling old things by new names. We may admit the close relationship between economics and business without making the terms interchangeable. There are some indeed who, as I think with much justification, call economics "the science of business." By such an expression they call attention to the fact that economics formulates the general principles which lie at the base of all business activity. On the other hand "business" as the word is generally used refers to the rules and practice of individual business undertakings. We impair the usefulness of language when we obliterate the distinctions between different expressions.

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*Abstract of discussion at the seventy-ninth Annual Meeting of the American Statistical Association.

I trust that it will not appear as if these considerations have been put forward for the mere pleasure of dwelling upon the obvious. There has not been to my knowledge any attempt to define "business statistics" and we can only infer what men mean by the use which they make of terms. There has been no effort of which I am aware to describe carefully the field of business statistics, and determine its relation to other fields of statistical effort. Perhaps the recent publication of a series of essays to which the editor, Dr. Copeland, has given the label "Business Statistics" may be deemed the first faltering step toward a comprehensive survey of the field. But the very nature of the book precludes anything like a well-ordered, systematic presentation of the subject. Neither in its plan nor its detail will you find a clear-cut conception of what is or what ought to be the distinctive field of business statistics. You will, however, find innumerable references to the business use of general statistics, which if you agree with what has thus far been said, ought not to be designated as "business statistics."

If this were the only thing that writers call "business statistics" we could make short shrift with this designation and without further ado cast it into the limbo of outer darkness. But a study of business literature in its original sources or in Dr. Copeland's excerpts shows that "business statistics" goes much beyond this.

We read in one of the essays that Dr. Copeland has selected that "business is more and more probing into the past for a solid basis of fact upon which to base future growth." Here I think we find a definite concept of distinctive business statistics—a record of past achievements within a business enterprise so ordered and arranged that it can serve as a basis of future policies.

Here there seems to be a plant indigenous to business and unlike any other which the statistical botanist has been called upon to classify. Moreover, it has borne rich fruits.

Through that constant research into the operations of individual enterprises we are gradually accumulating a large store of information on such topics as production, sales, stock turnover, advertising, employment, labor turnover, service rendered and similar topics.

It might be objected that however interesting such knowledge might be, it is individual, not general, and therefore not statistical. The objection sounds plausible in suggesting a distinction between results of purely casual and of systematic observation. But it is not valid in its assumption that systematic observation must comprehend the totality of the field under review. If we were to make the universality of the observation the criterion of what might be called statistics, we should have to throw into the discard many well-established branches of statistics, especially in the economic field. After all the only pertinent inquiry is whether the figures involved have been gathered and whether they are utilized in accordance with sound statistical methods.

That business in gathering its data is proceeding by statistical methods is at once suggested by the phrase before quoted, that it is probing into the records of the past. In other words, it is not content with present records, is too impatient to wait for future results, but is reconstituting as far as possible, past experience on a basis which will afford a comparable record. Indeed an examination into the concrete materials which have been quarried from business records shows that there is greater opportunity for statistical comparisons and conclusions than would at first glance seem probable. There is not only the obvious comparison in time between business results of today and yesterday expressed in terms of figures, but also ratios which may be established between the different component elements of these results, and not infrequently comparisons with other enterprises of an analogous character.

There is not the slightest question in my mind that as statisticians, we should recognize a field of business statistics, which is the natural outgrowth of business administration, just as government statistics are the result of political administration. It is a familiar fact that statistics as we commonly know them have their roots in some administrative necessity of the government, a rule almost without exception. They are at once the fruit of government administration and the necessary basis for its actions.

Administration is nothing more than the business of conducting the government's operations. At a time when statistics had their birth the task of government administration was probably the biggest form of business. It was, moreover, a business conducted through many agents where responsibility could only be defined by a system of definite reports and extensive records. Now the point which I should like to drive home is that, when any continuous undertaking attains a certain magnitude of operation, it naturally resorts to statistics. It is immaterial whether the undertaking be public, one of government, or private, one of business. The magnitude of modern business undertakings is therefore the underlying cause of the development of business statistics. Not a few of our modern enterprises surpass in the extent of their operations, many governmental administrations. Private administrations of this order feel the same need for comprehensive statistics (records of operations) as do nations, states and cities. Thus we note a further analogy between business statistics and the more familiar government statistics.

It follows from the fact that business statistics are the outgrowth of the records of individual business enterprises that in their specific content they will be as diverse as the sources from which they spring. This does not, however, preclude a family likeness in the results obtained from different establishments in the same line of business activity. Nor does the diversity in specific contents render futile an attempt to classify the results of business statistics into certain large groups which exhibit the scope and possibilities of such statistics.

To my mind what is most needed in this field of statistics today is a clear-cut conception of what the field actually is. If the business man has a comprehensive view of the kind of information obtainable by statistical research in business he can judge more intelligently whether in his own particular business he can derive profit from definite information of this sort concerning his own operations. Thus an intelligent understanding of what business statistics is may serve to enrich the product which is now available for practical and scientific purposes.

An examination of the material which has thus far been published under the name of "business statistics" leads me to believe that it may be summarized as an analysis of three things—work done, expense incurred, and service rendered.

In a factory the work done is represented by the number and kinds of its products. Here cost accounting deals with the units while business statistics are concerned with the aggregates. In a sales organization whether it be that of a factory, a mercantile establishment or an office (*e. g.*, an insurance company), the work done consists of the number of things of each kind which are sold. The accountant makes an accurate record of the financial results of these operations while the statistician takes especial cognizance of the items which enter into these results.

In any business the expense incurred whether it be for materials purchased for production, goods bought to be sold again, supplies purchased, labor hired or what not, finds an expression in the books of accounts. These records are concerned chiefly with values. The statistician analyzes the various items of expense by quantities and kinds, and thus supplements the work of the accountant. As a specific illustration of this expense analysis reference might be made to the careful and comprehensive records which have been developed by well organized advertising departments.

Again business statistics deal with services rendered, and this includes the service of employees and the service rendered to customers. The books of account tell us, for example, the amount expended in labor. An analysis of the persons receiving these payments has led in some concerns to an intimate knowledge of the labor turnover and to the adoption of business policies designed to reduce it. It has illuminated the causes of shifting within the labor force. The sales manager who compares the records of his salesmen also analyzes service rendered.

Service to customers has had a careful analysis by public service corporations, and banks and many mercantile establishments have found it profitable to make similar studies.

Briefly outlined such seems to me to be the field within which we can look for a development of business statistics. Just how widely it will be cultivated in the future depends of course upon the judgment of the individual business man. But it has been born of necessity, the growth in size of individual enterprises. That need according to all the probabilities, will be greater in the future than in the past.

In the field under consideration accounting and statistics touch one another closely. Indeed much of our present knowledge in this field has been the work of accounting departments. So far as this is the case it would be correct to say that while some business statistics have been the product of accountants, they are not the fruit of accounting. A homely illustration will perhaps serve to bring out the close relationship and the clear distinction between accounting and business statistics. One of the most wearisome though essential features in bookkeeping is the making out of invoices. On the left hand side of the paper one enters goods, quantities and prices which appear only as a means to an end namely the money results recorded at the right of the page. Now business statistics takes up these neglected elements and analyzes them. It speaks in terms of quantities and kinds, while accounting deals with values. Each is concerned with business operations, but each views them through different glasses.

The business world is keenly alive to its statistical needs. It is much to be desired that the development of its statistical products should enlist the interest of trained statisticians and not be left entirely to the devices of the accountant, or the vagaries of untrained business experts.

INFANT MORTALITY STUDIES OF THE CHILDREN'S BUREAU.*

BY ROBERT M. WOODBURY.

Infant mortality studies have been made by the Children's Bureau in eight cities,† characterized by various and industrial and social conditions. The reports for Johnstown, Pa., and Manchester, N. H., have already been published. Besides these, field studies have been made in Saginaw, Mich., Waterbury, Conn., Brockton and New Bedford, Mass., Akron, Ohio, and Baltimore, Md. Of these cities Baltimore is in many respects the most interesting since it contains a large negro population; the data here are for a large number of births and deaths and offer therefore a basis for valid conclusions on many interesting problems.

The object of these studies is to show the causes of infant mortality and the relation between the mortality rates and social, economic, and physical ‡ factors. For this purpose as well as for the purpose of comparing rates under different industrial conditions, infant mortality rates must be available that are substantially accurate. Records of births and deaths of the Census Bureau are indeed available for calculating rates for cities in the birth registration area, but the margin of error varies from city to city, and probably from class to class in the same city; further, many points of information that were deemed important in a study of causes are not included in the registration records. The method adopted, therefore, was to supplement the registration records by inquiries covering type of feeding, earnings of father, color and nativity of mother, employment of mother, housing conditions, age of mother at birth, order of birth, maternal history, etc. With the results obtained it became possible for the first time in this country to study the effect of these various factors upon the mortality under one year of age.§

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* Paper read at the seventy-ninth Annual Meeting of the American Statistical Association.

† Exclusive of Montclair, N. J., already published. In Montclair, the schedules were furnished by the Bureau, and the data tabulated, but the information was not gathered by the Bureau's agents.

‡ Sex of infant, single and plural birth, prematurity, age of mother, order of birth.

§ With the possible exception of the study made by the Bureau of Labor on Infant Mortality and its Relation to the Employment of Mothers, Vol. xiii of Report on Condition of Woman and Child Wage Earners in the United States, 61st Cong., 2nd Sess., Sen. Doc. No. 645. The Massachusetts statistics did not permit of anything more than unsatisfactory general correlations; the Fall River investigation was based on a study of deaths only.

An infant mortality rate expresses the probability of a live born infant dying before the first birthday per 1,000 live born infants. The usual approximate method of calculation is to compare all deaths in the city in a given year to all births in the city in the same interval—a method that is open to the objection that the deaths in the city may include some deaths of infants born elsewhere and some of infants born in the preceding year. When deaths and births are subclassified by race, nationality, economic status of father, etc., the effect of these inaccuracies becomes difficult to estimate. Accordingly the method followed by the Bureau in all of its studies has been to follow each infant born in a given selected year from birth till death or till the first birthday was reached. In this way, in theory, for each nationality or economic or other subclass a probability of dying in the first year of life is secured, each rate accurate and comparable with the other rates obtained.

In practice, however, difficulties arose. How were all births in the city in the year selected to be discovered? The obvious method was to search the birth records, and the facility afforded by these records was an important factor in the choice of cities to be investigated. But these records are faulty; in some cities a considerable percentage of births is not registered, in others only a few are omitted. Some evidence of faulty registration is given in the death records themselves; a death record may be at hand of an infant (born in the city) for whom no birth record is available. Records are probably more complete in a state like Massachusetts where certification is carefully checked every year than in a state where both the idea of registration is new and the officials have not learned the administrative methods necessary to secure complete registration. In the absence of a careful canvass it may be difficult to determine how complete the records of births are. Records of deaths are likewise often incomplete, though in general laws requiring death registration are more widely adopted and better enforced than those for birth registration.* If exactly the same percentage of deaths as of births is omitted, in each class studied, the mortality rates will still be correct; but in most cases these percentages will not be identical, and usually the percentage of omissions of births will exceed that for deaths. In any case it is important to discover in what direction the errors in the mortality rates lie, and what procedure may best reduce or eliminate these errors or safeguard the conclusions.

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*In Saginaw 3 deaths among 118 were found to have escaped registration; 149 births were added to 1,113 that had been registered.

In other words, the varying incompleteness of registration, which affects not only the general rate for the city but also the rate for each subclass and possibly also the comparability of these rates, is a serious difficulty. The question is put whether, by selecting a certain group for study, it would be possible to secure complete records for that group that would be somewhat more reliable than records for the city. The groups where the rates are most open to question and the facts most difficult to obtain are the births to migratory and non-resident mothers and the illegitimate births.

The migratory group where the family has moved away from the city is especially difficult to follow. Thorough and complete investigation would multiply the expense of inquiry, if indeed it were possible in all cases to find the mother to secure the information. It is certainly admissible to treat this migratory group separately; separate treatment seems especially advisable in view of the fact that the deaths in the group of infants born in the city and removed is not a complete tally because only the early deaths are certain to be registered. It would be interesting to know whether the fact that the family moved or that the family is a migratory one has any influence on mortality rates, but as yet the information secured has seemed so unsatisfactory that the results for this group have not been published.

One consideration upon which this policy of excluding migratory families was based was that the rates were to characterize the city; that housing conditions inseparable from geographical location, climate, etc., and especially local industrial, economic and social conditions materially affected mortality. Strictly speaking, the numerator of the fraction expressing the mortality rate should then include all deaths of infants in the locality, and the denominator the total number of years lived by all infants in the city. But in case of infants born elsewhere, the mortality and health might depend upon or be influenced by conditions elsewhere, and the infants born to non-resident mothers might have either better or poorer chances of life due to conditions not peculiar to the locality. The inclusion of such cases among the deaths and the life time corresponding might therefore slightly influence the rates. In one class of cases in particular this influence would be marked; special hospital maternity cases, where infant mortality is considerably more than average, may include many non-resident mothers. Accordingly, to make the result as characteristic of the city as possible, all births to non-resident mothers were excluded. But in the main, the mortality rates are determined more by the type of feeding, economic class, etc., and the proportion of each class in the city, than by geographic and purely local climatic conditions.

A further reason for the exclusion or separate treatment of migratory families is the difficulty of securing an adequate statement of the years lived in the city. There are no data of the average age of infants moving away nor, for that matter, of the average age of infants moving in from the outside. If this information were available it would be possible to make monthly rates of mortality and to compare the monthly rates for migratory families with the rates where the family remained in the city.

A corollary of this policy of exclusion is that deaths in the city of infants born to mothers who later moved away prior to the visit of the agent have to be excluded. If not, the policy of exclusion would subtract only from the life time lived in the city without any deaths to correspond. A special class of cases is where the mother died. These cases are included if the infant or the family was living in the city at the time of the visit of the agent and excluded if the family had moved away.

The illegitimate births present certain special problems. There are difficulties in securing accurate information, for the families are frequently "non-resident" or have moved away. Nor are the data secured as trustworthy as for legitimate births. Furthermore, the conditions surrounding these infants are not those of the normal family, and these births should therefore be given separate treatment. In some cities no attempt was made to secure schedules for the illegitimate births. In Baltimore the subject will be treated in a separate chapter.

The data presented then are reasonably complete and accurate for the legitimate births in the selected year to resident mothers living in the city at the time of the investigation.

For the rest, with migrant and non-resident and illegitimate groups excluded, three general methods of selection of the group are available. One is to take the records as they are, treating each death record as a birth record if the birth actually occurred in the city. The second is to take records of births as the starting point and accept records of deaths only when the birth record is available. The third is to supplement the records of births and deaths by a thorough canvass.

The three methods will give exactly the same results if the records are complete. If the records are not complete, the choice of method may be affected by the character and extent of the omissions. If death registration is complete but birth registration faulty, the first method will obviously give too high rates; if birth registration is nearly complete among the native but faulty among the foreign born, the method will exaggerate the differences between the infant mortality rates for the nativity classes.

The second method is an attempt to avoid the bias of the first method by the selection of births among whom the deaths are complete. The rates for each class of selected births are formed by comparing the number of infants that died (birth registered) with the sum of the infants that died plus those that survived the first birthday. These rates are correct in the sense that it is ascertained for each legitimate infant (of the resident group) whose birth was registered whether the infant survived or did not survive at the first birthday. Whether the rates are typical of the group is another and quite as vital a question; are enough infants that died associated with the infants that lived in each group to make a typical rate? Births in the more well-to-do families are more likely to be registered than in poorer families; the mortality rate for the group of infants selected on the basis of registration of birth tends, therefore, to be somewhat lower than the rate for all births. At first thought, it might appear that, in spite of this tendency away from a rate typical of the entire group, the rates for each subgroup would be typical and allow of safe comparisons. But even here, the same tendency may show itself, the births in the more intelligent and better situated subgroups being more likely to be registered and therefore with fewer deaths among them to be associated with the registered births. Other reasons may affect the comparability of rates for these groups. If there is any connection between death of the infant and registration or non-registration of birth, the method will obviously give biassed rates. For example, if the physician on registering a death remembers and records the hitherto unrecorded birth; or if a doctor is called in case of an infant death shortly after birth where in case of survival for the first few days a midwife only is in attendance, the rate may be biassed; for the birth would be more likely to be recorded in case of death than if the infant survived the critical period of the first few days. But if the physician defers registration of birth and thinks it unnecessary if he has to record the death in a few days after birth, the rates will be biassed in the other direction. If these tendencies affect the well-to-do and poor differently or in different degrees, comparative rates may not tell the true degree of difference in rates between these classes. The method purports to be an unbiassed method of selection; it is unbiassed as far as personal or arbitrary bias of the investigator is concerned; but it may actually be biassed in favor of low rates for the entire group or for certain subgroups. It is therefore necessary even with this method to test the presence and determine the character of bias.

Several of the studies of the Bureau have been made on the basis of registered births: Manchester, Brockton, and New Bedford. An illustration of the effect of bias in the method of selection is afforded by Saginaw; the mortality rate for infants of foreign born mothers in the lowest income group came out approximately 50 per 1,000, nearly as low as the rate for infants of native mothers of the highest income group. When the infants that had been excluded on account of non-registration of birth were added the rate was much higher and more in accordance with what other studies have shown. Another peculiarity of the Saginaw material is the fact that in the group of infants of foreign born mothers there were no deaths of infants aged less than 1 day reported. The usual percentage is about 15, and though the total number is small (only 20) the absence of deaths under one day is a trifle suspicious. That no stillbirths were reported by midwives may possibly be due to erroneous or neglected registration.

The third method assumes in absence of evidence that both birth and death records are likely to be deficient and attempts by the best methods available to remedy the deficiencies. Whether all births and deaths would be discovered would depend on the scope and carefulness of the canvass.

In a word, the first method usually errs in overstating the mortality rate; the second and third methods attempt to secure more accurate rates, the second by selection of births and the third by supplementing the data.

The choice of method is frequently limited by the practise of the registration office. In Waterbury and Baltimore, for example, if an infant death was recorded where the birth had occurred in the city, the birth was immediately recorded if not previously registered. The distinction here, between the first and second methods, became impossible to make. In several cities, therefore, and especially in those cities with faulty birth registration, the records have been supplemented by a canvass or in other ways. In Saginaw, 149 live births were added to total of 1,113 even without a systematic canvass, by use of baptismal records and neighborhood inquiry. In Waterbury, 329 unregistered live births were added to the 2,239 registered. In Akron (outside of the birth registration area), a canvass was obviously necessary. In Baltimore, a campaign for complete birth registration by all the civic and social agencies was being conducted during the progress of the infant mortality study with the result that many births were added.* The tendency, therefore, has been to resort to the method of supplementing official records by a canvass.

In this connection the exclusion or separate treatment of migratory families is the more justified because it fits in with the plan of securing additional information by a canvass and simplifies the problem very greatly. If the group to be studied includes only cases where the infant is born in the year selected and the family is living in the city at the time of the canvass it becomes at least possible with a thorough canvass to locate all births and deaths that ought to be included. The death records need be supplemented only by deaths of infants born to mothers who are still living in the city, normally these deaths will be recorded. The birth records are to be supplemented by the addition of any children living in the city at the time of the canvass, who were born in the city in the selected year. Of course some difficulties still exist. But in the main the procedure is simple and the data for this "canvassable" group are reasonably complete and accurate.

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* In Brockton and New Bedford a canvass is made by special state agents to correct registrations; additional births discovered are added to the registered births.

In any of these methods there arise interesting and often perplexing problems of identification. Sometimes an infant's name is spelled in one way on the birth certificate and in another on the certificate of death.[*] The phonetic spelling of the name by the doctor who makes the return may not agree at all with the spelling preferred by the family of the child. These cases are fairly common among the foreign groups, especially with the perplexing names of Poles and Lithuanians. It is sometimes difficult to locate families even when they have not moved, as in one section of Waterbury where the foreigners —this is a free country indeed—chose lucky numbers for their houses. Families that move once or twice to other places within the city are often hard to locate because neighbors do not always remember the new address. If a canvass of the city is made these families are found at the correct addresses by the canvassers.[†]

Turning to the analysis of results, in the Baltimore material we have for the first time in these studies a large enough number of colored infants to give a significant mortality rate. The rate for white infants is 95.9; for colored, 158.6, or 65 per cent higher.[‡] The foreign born in Baltimore have the same rate as the native; but analysis of the foreign born group show striking differences among the different nationalities, differences that have been revealed in other studies. The Hebrews have the remarkably low rate of 51.0, the Poles, on the other hand, the high rate of 163.2.

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[*] For example, Zartsch and Sage, Greenwood and Boisvert.

[†] There are always a few cases that can not be traced, for whom it can not be determined even that they have moved away. These cases are omitted, the chances being that they belong rather to the migrant than to the resident group, especially if a canvass is made and fails to locate them within the city.

[‡] All figures for Baltimore are provisional.

For fathers' earnings groups the rates decrease from the rate (maximum) of 156.7 for the group with earnings under $450 to 37.2 (minimum) for infants whose fathers earned $1,850 or over.

TABLE I.
INFANT MORTALITY RATE BY FATHERS' EARNINGS.

Earnings of Father	Infant Mortality Rate	Live Births	Deaths
All classes	103.5	10,797	1,117
Under $450	156.7	1,544	242
$450–$549	118.0	1,449	171
$550–$649	108.8	1,489	162
$650–$849	96.0	2,417	232
$850–$1,049	71.5	1,595	114
$1,050–$1,249	66.6	661	44
$1,250–$1,449	74.0	419	31
$1,450–$1,849	86.3	371	32
$1,850 and more	37.2	431	16
No earnings	207.7	207	43
Not reported	140.2	214	30

The effect of the kind of feeding can be discussed intelligently only in connection with the age of the infant in intervals of less than a year because of the changes in the proportion of infants artificially fed at different ages. In the following chart for Baltimore the monthly death rates are shown for artificially fed and breast fed infants and the probability of dying in the month is given for all infants except those not fed. The rates for the artificially fed are from three to nine times those for breast fed infants. The relative percentage disparity between the rates is greatest from the third to the eighth months and is greater for these than for the first month. In this respect the figures agree with the data for Berlin for 1895–96, though there the rates for the artificially fed were considerably higher than in Baltimore.

Besides the two main groups there is a group of infants with mixed feeding. The rates for this group lie midway between the rates for the other groups; for the first month it is nearly equal to the rate for the artificially fed, but for later months it approximates more closely the rate for breast fed infants. For all of these groups the type of feeding taken is that for the major part of the month, or, which amounts to the same thing,

TABLE II.

MONTHLY PROBABILITY OF DYING PER 1,000 SURVIVING AT BEGINNING OF SPECIFIED MONTH OF LIFE AND MONTHLY DEATH RATES BY TYPE OF FEEDING IN BALTIMORE, 1915.

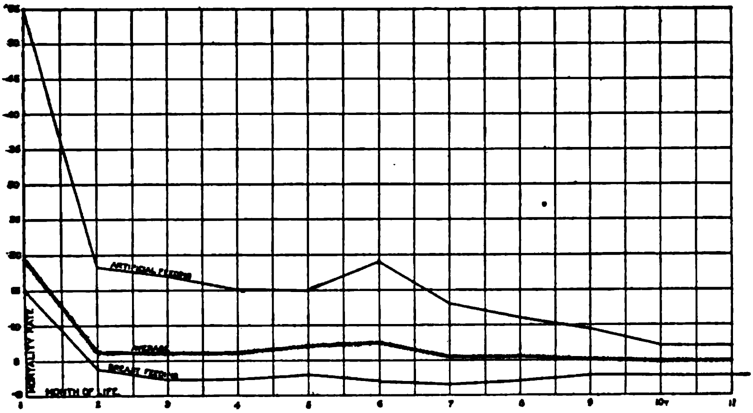
Month of Life	All Infants	Breast Fed	Mixed	Artificially Fed	Relative Difference*
1	(44.1) 19.8†	15.0	42.7	55.3	3.7
2	6.3	3.8	4.9	18.9	5.0
3	6.1	2.4	9.5	17.0	7.0
4	6.1	2.3	5.2	15.3	6.6
5	7.0	3.0	5.6	15.1	5.0
6	7.6	2.1	4.0	19.1	9.1
7	5.6	1.7	3.2	13.0	7.7
8	5.6	2.2	3.3	11.2	5.1
9	5.2	2.8	3.1	9.5	3.4
10–12	14.3‡	8.2‡	7.0‡	28.8‡	3.5

* Relative difference between artificial and breast feeding, column 4 divided by column 2.

† Figure is for probability of dying for infants who lived long enough to be fed, the figure in parentheses is the probability of dying for all live born infants.

‡ Figures are, first column, probability of dying before end of year per 1,000 infants surviving at beginning of the tenth month; second to fourth columns, deaths in tenth to twelfth months per 1,000 infants at risk at beginning of period

CHART I. MONTHLY PROBABILITY OF DYING IN THE FIRST YEAR OF LIFE, AND MONTHLY DEATH RATES BY TYPE OF FEEDING.*



* Figures in Table II.

for the middle day of the month. The number of infants that died breast fed is therefore divided by the approximate number of months lived by breast fed infants for the month of life considered, giving a monthly death rate for this type of feeding.*

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* The information for infants for whom the type of feeding changed during the month is scarcely so accurate as suggested in the discussion. The above treatment would give the correct result if the data were gathered in every case according to instructions. In cases where instructions were not followed, the above treatment would be as safe as any. Such cases would form a relatively small proportion of the total.

TABLE III.

DEATHS PER 10,000 LIVING AT EACH AGE ACCORDING TO TYPE OF FEEDING: BERLIN, 1895-96.*

Age in Months	Breast Milk	Cows' (and Goats') Milk	Column 2 Divided by Column 1
0	201	1120	5.6
1	74	588	7.9
2	46	497	10.8
3	37	465	12.6
4	26	370	14.2
5	26	311	12.0
6	26	277	10.7
7	24	241	10.0
8	30	213	7.1
9	30	191	6.4
10	31	168	5.4
11	39	147	3.8

* Except last column, from Westergaard, H., *Die Lehre von der Mortalität und Morbilität*, 2nd Ed., Jena, 1901, p. 361. Results of Böckh for Berlin, based on census of infants in city (.2 unknown) and death certificates—(exclusive of infants who died in first day, the type of feeding was unknown in one seventh of deaths, for 1896, these were distributed pro rata of known cases.)

The results of the table for Baltimore may be stated in other words. If the rate for the artificially fed had been the same as that for the breast fed infants, only 92 instead of 437 deaths would have occurred among the former group. The rate for breast fed was only 21.3 per cent. of that for the artificially fed on an average. If all the infants had been breast fed and the same rate had applied to all as characterized the breast fed infants the total deaths of the group studied would have been reduced by 345, from 1,117 to 772, the rate from 103.5 to 71.5 per 1,000 live births.

Of course some of the artificially fed babies may be weaker than their more fortunate brothers. One might assume the effect of such weakness, if it necessitated artificial feeding, would be especially marked in the first month of life. But the relative difference in the rates is greater for the third and later months than for the first and second. Light may be thrown on the effect of continued artificial feeding and of a shift of feeding by an analysis of mortality rates by duration of each type of feeding.

Analysis of mortality rates for each type of feeding by economic conditions might reveal clearly the effects of other elements in mortality. As far as nativity of mother is concerned the evidence shows in most cases that a larger proportion of native mothers than of foreign born mothers feed their infants artificially. The differences between the average rates for the two groups, therefore, is somewhat minimized by neglecting to make a secondary analysis by nativity classes. A difficulty in interpreting the results of such a secondary analysis, however, is that artificial feeding does not always have the same implications. The native mother may be more careful in preparation of the cows' milk for the baby, she may make use of the formulae for modifying the milk that insure the best results. This difference in the meaning of artificial feeding for the nativity groups must be taken into consideration in interpreting the conclusions.

Another problem is the question of the effect upon mortality of employment of the mother in the year following the birth of the infant. It has been shown that a relatively small percentage of mothers are gainfully employed away from home. In Baltimore, mothers of 859 infants, or 8.0 per cent. of the total, were employed away from home during the lifetime of the infant. In Waterbury only 3.4 per cent. of the infants had mothers so employed, an even smaller proportion of the total. The general mortality rate for the city could not be primarily influenced or much affected by a high mortality among infants whose mothers were gainfully employed. It is quite possible, however, that gainful employment of the mother away from home may increase considerably the mortality rate *among the infants of these mothers.* To determine this effect it is necessary to know the age of the infant at the time the mother went to work.*

In Baltimore, of these 859 infants whose mothers were gainfully employed away from home, 78 died. If the rate for all infants had been applied to these infants at the ages at which the mothers went to work only 39 deaths would have resulted. In other words the mortality rate of infants whose mothers were gainfully employed during the lifetime of the infant was about twice the average rate.

Further analysis might determine whether this excess mortality was due merely to the necessity of artificial feeding or to the preponderance among the group of infants of colored mothers or of infants in the low income groups. If gainful employment of the mother involves artificial feeding the mortality among the infants would normally be high; artificial feeding, however, may not be sufficient to account for the difference. If a large majority of those gainfully employed were colored, one would expect more deaths than if the mothers were white; and similarly if a large proportion were in the relatively poorer classes, as undoubtedly was the case. Extended analysis may indeed show, as suggested by Hibbs,* that the earnings of the mother, by providing means for extra care and somewhat better conditions, may more than make up for the handicap under which the infant suffers through absence of the mother during work hours. By calculating the deaths that would have occurred among the infants of mothers gainfully employed for each such group at the rate for the subgroup (colored, white, poor, well-to-do, etc.), applied to the corresponding numbers in it, first with the rate for breast fed infants and then with that for artificially fed infants, it would be possible to show how much handicapped these infants are by reason of not being breast fed and how far, if at all, they are favored over the artificially fed infants of mothers who are not gainfully employed.

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* If the infant died before the mother went to work or resumed employment, the death can not be attributed to the employment of the mother.

These studies throw light upon the connection between the death of the mother and infant mortality. It is to be expected that when the infant is deprived of the mother's care the mortality would be higher. In Waterbury there were 16 live births to mothers who died during the year following confinement. At the average rate of mortality for the city (122), two deaths would have occurred among them but actually six deaths occurred, or three times as many. In Baltimore there were 68 live births to mothers who did not survive the next year. At the average rate for the city 7 deaths would have occurred; there were actually 34 deaths or nearly five times as many.†

A very interesting fact is brought to light in examining the proportion of families of a given number of births that had no infant deaths. In families of two births if the mortality rate is 100 or one in ten die, the probability that both children die before the end of the first year is one in 100, and that both children survive the first year 81/100. Similarly for families of *n* births, if q is the probability of surviving the first year, q^n is the proportion of families where all infants survive. A comparison of the actual and expected rates as so calculated reveals the interesting fact that there are more families with no deaths than would be expected by the laws of chance: in other words the deaths are found to be slightly concentrated in relatively few families. That this result is not strange follows directly from the consideration that when the care given by the mother is unusually good, or when the physique inherited by the infant safeguards him through his first year of life, it is likely that his later brothers and sisters will enjoy the same advantages as he. The occurrence of infant deaths among the later births is not entirely independent of the causes leading to deaths among the earlier births in the same families.

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* But not demonstrated; the figures quoted are for the Johnstown report of the Children's Bureau, in which no analysis is made of the age of infants at the time of the mother's resumption of employment. The figures then merely compare infant mortality in families where the mother works with that in families where the mother is not employed; this comparison is an essentially different proposition and is not so directly related to the problem. Hibbs, Henry H., Infant Mortality: Its Relation to Social and Industrial Conditions, p. 108.

† Cf. Westergaard, H., *Die Lehre von der Mortalität und Morbilität*, 2nd. Ed., Jena, 1901, p. 376.

A study of the effect on mortality of the interval between births is permitted, though not as directly as might be wished, by a classification of births by age of mother and order of birth. Where the mother is under 20, and two or more births have occurred, it is highly probable that the interval between births has been short; by a combination of age of mother and order of pregnancy, it appears that the rates for the later numbers in order of pregnancy advance rapidly, and always more rapidly the younger the age of the mother in the group considered. For third births, for example, the rate is 196 for mothers under 20, 129 for mothers 20–24, 99 for mothers 25–29, etc. For fifth births it is 184 for mothers 20–24, 134 for mothers 25–29, and 95 for mothers 30–34. Of course it is possible that a subclassification by color or economic conditions might explain some of those differences.

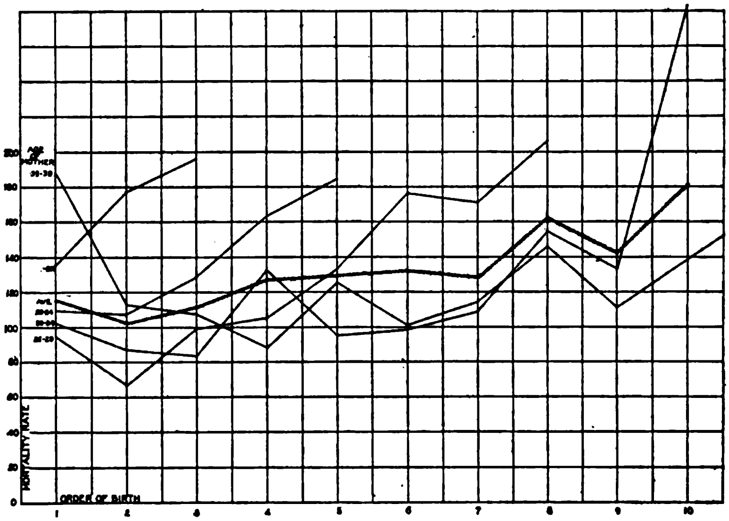
TABLE IV.

MORTALITY RATES BY AGE OF MOTHER AND ORDER OF BIRTH: BALTIMORE.*

Number in Order of Birth	Average	Age of Mother					
		Under 20	20–24	25–29	30–34	35–39	40 and Over
Average		148.1	118.6	107.7	112.8	126.7	131.2
1	115.8	135.1	109.8	95.1	102.4	(188)	.....
2	102.7	177.2	107.5	66.8	87.0	113.2	.....
3	111.5	196.4	128.7	99.4	83.5	107.6	.....
4	127.0	(290)	163.4	105.1	132.4	88.4	.....
5	129.3	.....	184.0	133.6	95.4	125.5	.....
6	132.2	.....	(179)	176.7	98.2	101.1	.....
7	128.2	.....	.....	171.6	108.7	114.5	.....
8	162.6	.....	.....	203.7	154.5	146.1	.....
9	142.1	.....	.....	(295)	133.0	111.1	.....
10	181.1	.....	.....	.....	282.3	138.4	.....
11	146.8	.....	.....	.....	.....	152.4	.....

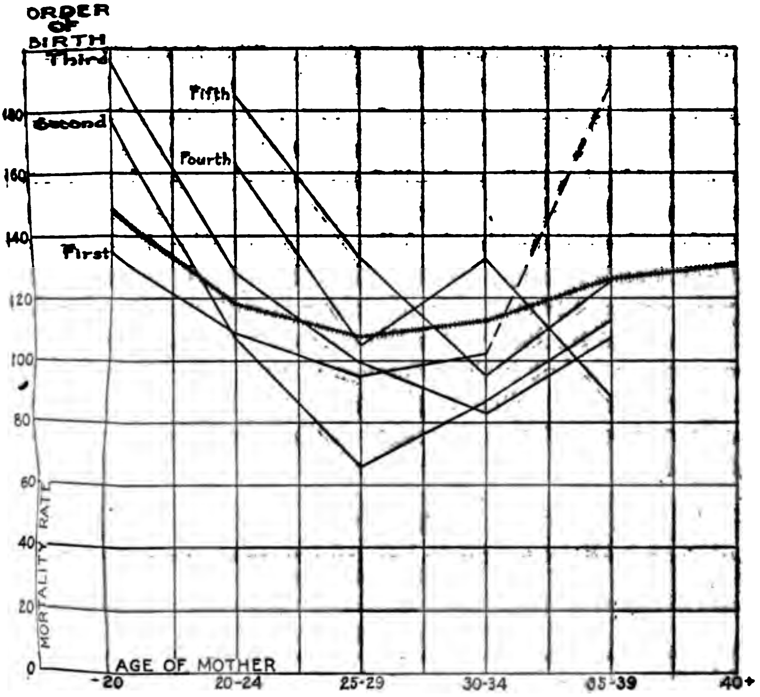
* Includes all births reported by mothers of infants born in Baltimore in 1915.
Rates bracketed based on fewer than 100 cases. Rates for twelfth and later births omitted.

CHART II. GRAPHS FOR EACH AGE-OF-MOTHER GROUP SHOWING VARIATION IN INFANT MORTALITY RATES BY ORDER OF BIRTH.*



* Figures in Table IV.

CHART III. GRAPHS FOR EACH ORDER OF BIRTH SHOWING VARIATION IN INFANT MORTALITY RATES BY AGE OF MOTHER.*



*Figures in Table IV.

The effect of lack of proper spacing between births can be studied by analysis of mortality rates for families of different sizes (number of births to mother) and average duration of married life. That the interval between births is short is obvious when the "terms" of married life are short and the number of births is relatively large; but for long durations of married life it is uncertain whether births have been properly spaced or not.

The results for Waterbury are shown in the accompanying table, giving the mortality rates for infants of mothers married less than 6 years, 6 to 10 years, 11 to 15 years and 16 years and over. In the first three groups the tendency is marked for the rate to increase as the interval, indicated by a large number of births, decreases.

The second table is an attempt to group the results more clearly in terms of the interval between the birth and the beginning of the succeeding pregnancy. The rates where the average interval between the birth of one child and the next pregnancy is approximately 1 year is considerably higher than where the interval is approximately 2 years or 3 years or over, 151.4, 111.2, and 102.3 respectively. An interesting feature of the table is the decided increase in the rate as the number of successive births following one another by intervals of less than 2 years increases. That the result is not explained by the increase in size of family alone is indicated by the fact that in large families where the average interval is over two years there is but little difference in rate from that for the smaller families. One might fairly conclude that an important cause of high mortality is the lack of proper spacing of births.*

TABLE V.

MORTALITY RATES BY LENGTH OF MARRIED LIFE AND NUMBER OF BIRTHS TO MOTHER: WATERBURY.

Number of Births	Length of Married Life											
	5 Years and Under			6-10 Years			11-15 Years			16 Years and Over		
	Live Births	Deaths	Rate	Live Births	Deaths	Rate	Live Births	Deaths	Rate	Live Births	Deaths	Rate
1...	469	47	100.2	11	0	0.0	...	..	.....	...	..	.....
2...	656	61	93.0	153	18	117.6	26	2	(77)	2	0	.....
3...	510	73	143.1	408	38	93.1	54	4	(74)	15	1	(67)
4...	146	28	191.8	676	82	121.2	157	16	101.9	46	6	(130)
5...	15	5	(333)	552	83	150.4	355	32	90.1	71	7	(99)
6...	...	..	.....	255	48	188.2	429	43	100.2	83	5	(60)
7...	...	..	.....	98	20	(204)	398	46	115.6	200	34	170.0
8...	...	..	.....	21	4	(190)	280	47	167.9	280	41	146.4
9...	...	..	.....	9	0	0.0	137	31	226.3	269	32	119.0
10..	...	..	.....	...	..	.....	60	19	(317)	314	49	156.1
11..	...	..	.....	...	..	.....	11	5	(455)	135	24	177.8
12..	...	..	.....	...	..	.....	12	8	(667)	140	24	171.4

Rates for 13 and over omitted.

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* Part of the differences in rates may be due to the tendency for the interval between births to be shortened in case of death of an infant. See page 47.

TABLE VI.

MORTALITY RATES BY APPROXIMATE AVERAGE INTERVAL BETWEEN BIRTH AND NEXT PREGNANCY BY NUMBER OF BIRTHS TO MOTHER: WATERBURY.

Number of Births	Average Interval 1 Year				Average Interval 2 Years				Average Interval 3 Years or Over			
	Years Married	No. Live Births	Deaths	Rate	Years Married	No. Live Births	Deaths	Rate	Years Married	No. Live Births	Deaths	Rate
2.......	— 4	590	55	93.2	5–6	141	14	99.3	7+	106	12	113.2
3.......	— 6	660	81	122.6	7–9	229	25	109.2	10+	98	10	(102)
4.......	— 7	562	89	158.4	8–11	307	26	84.7	12+	156	17	109.0
5.......	— 9	486	78	160.5	10–14	411	47	114.4	15+	96	8	(83)
6.......	—11	356	57	160.1	12–17	357	36	100.8	18+	54	3	(56)
7.......	—13	392	54	137.8	14–20	246	25	101.6	21+	28	1	(36)
8.......	—14	237	41	173.0	15–22	325	45	138.5	23+	19	6	(316)
9.......	—16	189	34	179.9	17+	222	29	130.6	....	...	..	.....
10.......	—18	217	49	225.8	19+	157	19	121.0	....	...	..	.....
11.......	—20	74	20	(270)	21+	72	9	(125)	....	...	..	.....
12.......	—21	82	24	(293)	22+	77	8	(104)	....	...	..	.....
2-12....	...	3,845	582	151.4	.....	2,544	283	111.2	....	557	57	102.3

Rates for 13 and over omitted; (6 mothers) 16 deaths, 77 live births.

A third method for the study of the effect of interval between births is available but hitherto not used. The schedules gathered show usually the age of the infant born in the selected year at the commencement of a later pregnancy as well as a rough statement of the interval between the birth of the child in the selected year and the preceding birth. By analysis of these it may be possible to determine the effect on mortality of the child following another by a short interval as well as of the child preceding another by a short interval: the effect in the two cases may be of different character and of different magnitude. By excluding infants that died before the commencement of next pregnancy, this method of procedure would have the obvious merit of eliminating the effect of a tendency, revealed in European statistics, for the interval between successive births to be shortened in case of the death of an infant at an early age.*

There remain two very important problems of treatment of data, both of which have been suggested in the foregoing. One is the problem of determining how many cases suffice to establish a conclusion. In the example cited, p. 42, is the fact that 34 deaths occurred, instead of 7 expected, among the 68 live births a sufficient basis for a conclusion that the death of the mother exercises an adverse effect on infant mortality? The problem may be stated in slightly different words: is the result due to a significant cause or causes or is it to be explained merely as a chance combination of insignificant or unimportant causes? If we can show that it is not explicable on ground of "chance combination of individually unimportant causes," we have taken a long step toward establishing the true causal connection, though it may or may not be true that the cause alleged is the important factor.[*] The procedure is simply to calculate the probability or improbability of the result occurring by chance, by analogy with the results of games of chance.

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* Cf. Westergaard, H., *Die Lehre von der Mortalität*, 2nd ed., pp. 370-1.

The proposition might be put as follows: If black and white balls are mixed in an urn in the proportion of 103 black to 1,000 total (the mortality rate in Baltimore was 103) and 68 are drawn at random, the most probable number of black balls would be 7. How frequently would 34 or more of the balls be black? It is easily seen and it can be mathematically shown that such a result is extremely improbable—it would occur but a few times in a million drawings. One may conclude, therefore, reverting to the problem under discussion, that some significant causes are acting to increase the mortality of infants in cases where the mother died, that there is a causal connection between the two.

The mathematical formula for the root mean square error (or, if preferred, the probable error) may be used to test the probability of a result occurring from a chance combination of of insignificant individual causes in connection with the differences between the observed and expected results. A deviation of three or four or more times the standard or mean error makes it practically certain that real causes are acting.[†]

The number of cases necessary to establish a conclusion depends (a) on the probabilities involved, and (b) on the amount of the differences between observed and expected results.

The second problem is that of separating the effect of two or more interrelated factors and assigning to each its proper and due weight. The problem may be made more concrete by discussion of some specific cases, for example, age of mother and order of birth, or race and earnings of father.

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[*] Compare the discussion on the effect on mortality of gainful employment of mothers, p. 41.

[†] The applicability to mortality rates of this procedure of comparison by analogy with results of game of chance has been discussed by Westergaard and others. Cf. Westergaard, H., *Die Lehre von der Mortalität*, 2nd Ed., pp. 186 ff., esp. 197–9. *Die Grundzüge der Theorie der Statistik*, ch. 5. Scope and Method of Statistics, QUARTERLY PUBLICATIONS, American Statistical Association, Vol. XV, pp. 244 ff., Sept., 1916.

The heavy lines in the charts show the variation in infant mortality by age of mother and by order of birth separately. But it is possible that the high rates for mothers over 40 is due to the large proportion of births of late orders to such mothers —births, among whom the mortality rate is high, or vice versa. How can these effects be separated?

Various methods have been suggested, the correlation coefficient, multiple correlation, some method of standard distribution, and Westergaard's method of expected and actual deaths.

Analysis of the problem shows that the method to be preferred depends upon the amount of information available. The object sought may be either to sum up in easily understood form the data of a complex table, or it may be to add to the information at hand by further analysis.

Suppose, for example, that infant mortality rates are at hand for various cities and that nothing is known of mortality rates for infants of native and foreign born, of illiterate and literate mothers, of mothers employed and not gainfully employed. Some light may be thrown on the relationship by securing indices of these factors for the different cities and classifying the cities by the size of the indices and average mortality rates, in other words by correlating mortality with the various indices. It will be readily admitted that the conclusions are likely to be precarious, first, because comparatively few cities may be used, second, because indices may not be very directly related to the problem investigated, and thirdly because important factors may be overlooked. A correlation may be found between infant mortality rates and the percentage of foreign born, which may be due solely to the poor registration of births in cities with a large percentage of foreign born. Where complex relationships, such as between the mortality rates and age of mother and order of birth, are investigated by this method, the selection of a true index becomes almost impossible, especially in case the relationship is not linear. Yet in absence of classified births and deaths, such a method of analysis may be better than nothing.

A second case is where it is sought by further analysis to determine which of two factors is the more important causally and to determine the limits of the effect of each. This problem appears in two forms: where the only available information is a series of rates for each factor separately, and where rates are given for each combination of both factors. In the latter case the problem is one of combining results and presenting the significant conclusion. But in order to determine the method of approach and the possibilities of analysis where only part of the information is available, it will be pertinent to give a few illustrative cases where conclusions based on partial data may be tested by the fuller information.

One difficulty in the interpretation of average rates for each factor separately is that the average may be influenced by the special distribution of births in each group. A second difficulty is the interpretation of causality. In the example under discussion it is probable that neither age of mother nor order of birth are per se "causes," but simply that they connote or imply conditions that favor high mortality—impaired physique, or lack of experience. Low age of mother may obviously connote a low order of birth. To the extent that one connotes the other, one is as significant as the other, except that one may be shown to be more directly related to the true cause. All that statistical analysis can show at best is the extent to which each factor connotes something not connoted by the other, and the extent to which both factors have the same connotations.

CASE 1. FACTORS INSEPARABLE.

(1,000 births assumed in each group where rate is shown.)

Age of Mother	Order of Birth.					
	Average	1	2	3	4	5
Average		100	110	120	130	140
20	100	100				
22	110		110			
25	120			120		
32	130				130	
38	140					140

CASE 2. AGE OF MOTHER SOLE CAUSAL FACTOR.

Age of Mother	Order of Birth					
	Average	1	2	3	4	5
Average		105	110	120	130	135
20	100	100				
22	110	110	110	110		
25	120		120	120	120	
32	130			130	130	130
38	140				140	140

CASE 3. ORDER OF BIRTH SOLE CAUSAL FACTOR

Age of Mother	Order of Birth					
	Average	1	2	3	4	5
Average		100	110	120	130	140
20	105	100	110			
22	110	100	110	120		
25	120		110	120	130	
32	130			120	130	140
38	135				130	140

CASE 4. BOTH FACTORS INFLUENTIAL.

Age of Mother	Order of Birth					
	Average	1	2	3	4	5
Average		105	120	140	160	175
20	105	100	110			
22	120	110	120	130		
25	140		130	140	150	
32	160			150	160	170
38	175				170	180

The average rates for the different orders of birth and for the different ages of the mothers show the same general trend in all four cases. It seems clear from a study of these examples that where merely the averages are given it is impossible to determine the relative effect of each factor.*

* Size of correlation coefficient appears to be inconclusive, if only averages for each factor are available.

If in addition to the average rates the distribution of births classified by both factors is given, it may be possible to throw some light upon the relative influence of each cause.[*] Perhaps the most satisfactory method is that suggested by Westergaard of calculating deaths on the assumption first of a uniform rate for each order of birth, and then for each age of mother, comparing the calculated with the actual deaths to determine the trend of the true differences. The method has its limitations. But applied to the cases given above, it indicates correctly (except for the first, which is indeterminate) which is the true causal factor, though perhaps minimizing its effect. The method is applicable even if the relationship between the rate and either or both factors is not linear. If another cause, such as interval between births, is more important than one of the factors under discussion the result is of course inconclusive to the extent that this cause has been disregarded.

If in addition to births the deaths are also subclassified, it becomes possible to give rates for each subgroup and to determine definitely the causal influence of each factor. The problem here is to combine the results in some easily understood form that epitomizes the data, showing the true weight of the causes considered. But for the statistician nothing can quite replace the rates themselves. For if some other cause is of considerable importance besides those presented, a summary process may obscure its effect and lead to erroneous conclusions. In the case under examination it becomes evident from the study of the charts showing the variation of rates for each order of birth by age of mother that the interval between births affects the mortality rates by age.

If the two factors are the only important ones to be considered, and the object is merely to present a result not affected or warped by a peculiar distribution of births, the best method is probably some form of the method of standards. For example, the difference between the rates for colored and white is somewhat exaggerated by the large proportion of colored in the lowest economic group. It is possible to present the true difference between colored and white either by calculating deaths in a *standard population* by applying first white and then colored rates: the sum of the deaths divided by the population gives the standardized rates. But it is rather better to use the actual distribution of population in the group as the *standard itself;* and calculate the deaths that would have occurred among the colored population if the rates prevalent among the white population had applied. The advantage of this method is simply that undue weight is not given to those rates which are based on relatively few cases, and that it is possible to present the number of cases upon which the rates are based so that the standard error may be calculated.

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[*] The character of the distribution of births often permits of approximately correct conclusions from the averages of two factors; it is where the distribution is "warped" that the conclusions need to be corrected. The method of a standard distribution is merely a substitution of a symmetrical for a "warped" distribution.

STATISTICAL WORK IN THE OFFICE OF THE SURGEON GENERAL OF THE ARMY.

By HORATIO M. POLLOCK, PH.D., *Statistician, New York State Hospital Commission.*

The statistics prepared in the office of the Surgeon General of the Army are of three kinds, namely:

I. Current statistics relating to the disease conditions of the army.

II. General vital statistics of the army.

III. Special statistics dealing with the work of experts recently called into the service.

I. CURRENT STATISTICS.

The office receives weekly telegraphic reports relative to diseases and deaths and general health conditions from each of the army camps, and a consolidated report from each of the departments; the department reports comprising all posts that do not report to the War Department direct. The information thus received is tabulated on a special form, and ratios are made for admissions to sick report and noneffectives and for the various diseases. A consolidated report is then prepared for the camps of the National Guard and the National Army. These reports are brought together and consolidated with the combined reports of the departments making a general report for the army as a whole. From these general reports a weekly statistical letter headed "Diseased Conditions Among Troops in the United States" is prepared. The figures for each division are entered week by week upon a form specially prepared for such purpose. This shows the variation of the weekly rates in the separate divisions. From these a combined form is prepared each week showing the rates for all the divisions. This furnishes the basis of comparison of the different divisions by weeks. From these data, charts are prepared for each division showing the admission and noneffective rates from week to week, and consolidated rates for the different infectious diseases in the National Guard, National Army and Regulars. This work furnishes a current statistical index of health conditions in the various camps and departments, and constitutes an important factor in health regulation in the different divisions of the army.

II. GENERAL VITAL STATISTICS.

The general vital statistics of the army now being compiled in the Surgeon General's Office are similar to those published in the Surgeon General's annual reports for many years. The increase in the size of the army, however, has necessitated a change in the method of handling the statistical material. The basis of the statistics here prepared is a schedule report card known as Form 52. This form gives detailed information concerning every case admitted to sick report that receives treatment for any conditions of importance. The information from these cards was formerly tabulated by hand methods. On account of the increased volume of the business a coding book and corresponding punch cards have been prepared and the data will be transferred to such cards and tabulated by machines.

The preparation of the coding book involved a revision of the classification and nomenclature of diseases and traumatisms. The classification of diseases previously used in the medical department of the army was the one known as the "Bellevue Classification." This classification, while an improvement on the classifications that preceded it, was unsatisfactory in many respects. With reference to nervous and mental diseases the coding book follows the classification already in use in the new division of neurology and psychiatry; the classification of mental diseases being the same as that adopted by the American Medico-Psychological Association at its meeting in New York in May, 1917. The new classification of traumatisms is very complete and its use will result in giving more detailed information concerning wounds than have previously appeared in our army reports.

III. SPECIAL STATISTICS.

The statistical work in the new divisions of the Surgeon General's Office may be illustrated by reference to the division of neurology, psychiatry and psychology which was organized under the direction of Major Pearce Bailey.

This division is separated into two sections, one dealing with neurology and psychiatry, the other with psychology. The work of the first section consists of two principal lines of activity: the examination of troops for the detection of nervous and mental disease and defect, and the care of the soldiers who become mentally ill. Up to the present time the work of examining has been the principal function of the section, but when active fighting begins the number of mentally ill to be cared for will probably assume large proportions.

As this division, like several others in the Surgeon General's Office, was organized after the entry of the United States in the war, and as neurological and psychiatric examinations of troops had never before been attempted on a large scale, there existed no system of records that would furnish an adequate accounting of the work performed or results accomplished. In the beginning examiners were sent to the various army reorganization camps and to the headquarters of the divisions of the National Guard in several states, and were instructed to send reports of the work performed to the Surgeon General's Office. The inadequacy of such reports was soon apparent. After a careful survey of the whole situation a system of records was adopted which it is hoped will ensure fairly uniform procedure on the part of examiners and reliable reports so classified that they may be combined, and desired information obtained therefrom.

Having in mind the necessity of keeping army records as simple as possible, three blank schedules were prepared. First, a form for the record of the neurological and psychiatric examinations. This blank contains a brief outline of the points to be covered in the examinations, and the order to be observed in reporting findings. The purpose of this form is to supply a definite record of the findings of the examiner that could be checked up by an expert in the office and finally be filed with the soldier's papers. Second, a statistical data card calling for certain facts concerning each case examined that was found to have nervous or mental disease or defect. The card provides for a specific diagnosis under one of the following heads: nervous disease, psychosis, psychoneurosis, constitutional psychopathic state, inebriety, and mental defect; together with data concerning the soldier's age, residence, race, nativity, economic condition, previous environment, previous diseases, army service, wounds and injuries, and family history. These blanks serve two important purposes: they form an adequate record and they require close study of cases by examiners. The third blank calls for a general numerical report to be submitted monthly by the senior medical examiner at each station. This blank calls for the organizations examined, the strength of command and a summary of examinations and disposal of cases. These reports give a general view of conditions in this field at each station and enable the statistician to compare the nervous and mental cases found with the total examined and the strength of command at the several stations.

The plan has nothing remarkable about it except its newness, it being the first effort on the part of our army authorities to conduct and record special examinations to determine the nervous and mental status of soldiers. The system of reports of examinations here outlined went into effect October 1, 1917, and reports for only two months have been received. Thus far from one to three per cent. of the men examined have been found to be mentally diseased or defective.

The section in psychology is engaged in testing the intelligence of troops at various cantonments, the purpose being to weed out those who are incapable of understanding orders and to discover those who possess superior intelligence. The latter, if otherwise capable, would naturally be assigned to responsible and difficult work. Major Yerkes and his assistants in this section have prepared an effective system of tests and records which enable the examiners to perform their work with accuracy and dispatch. The point scale of marking is used, and the relative standing of the men can be seen at a glance from the final rating sheet. In the early tests it was found that from two to six per cent. of the men were of a high order of intelligence and from three to five per cent., mentally deficient.

Each of the other new divisions in the Surgeon General's Office is compiling statistical records of its special work.

The results when finally brought together will constitute a remarkable chapter in medical and military annals.

VISITING NURSING AND LIFE INSURANCE.

STATISTICAL SUMMARY OF RESULTS OF EIGHT YEARS OF PUBLIC HEALTH NURSING FOR INDUSTRIAL POLICYHOLDERS OF THE METROPOLITAN LIFE INSURANCE COMPANY, NEW YORK.

BY LEE K. FRANKEL, PH.D.
and
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INTRODUCTORY.

The Visiting Nurse Service for policyholders of its Industrial Department was instituted by the Metropolitan Life Insurance Company in June, 1909. At first it was experimentally introduced in New York City. The results soon warranted an extension of the service to other cities. It has been opened up systematically as local facilities permitted, so that at the close of 1916 it was available to over 90 per cent. of the ten and one-half million policyholders in the Company's Industrial Department, in about two thousand cities and towns in the United States and Canada. In the year 1916, 217,422 cases received nursing attention and over one million visits were made. Such has been the growth of a public health activity modestly begun only a few years ago, indicating the great public need for such work. This report presents fully the statistical history and the present status of the visiting nurse service of the Company. It considers the facts of its growth and gives details of its accomplishments as part of the public health movement in the United States and Canada. It is hoped that this account may prove of value to those engaged in public health work, and that it may serve in the effort to standardize visiting nursing activities.

GROWTH OF THE SERVICE.

The following table shows the growth of the service in the number of cases under care, the number of visits, total cost of the service, and the number of cities and towns included in its operation for each of the fiscal years of operation since 1909.

TABLE I.

NUMBER OF CASES AND VISITS, CITIES AND TOWNS SERVED—TOTAL ANNUAL COST—VISITING NURSE SERVICE, FISCAL YEARS 1909-1916.

Year	No. of Cases	No. of Visits	No. of Cities and Towns	Total Annual Cost
1909	4,723	28,442	13	$ 13,685.37
1910	31,369	290,963	213	127,368.41
1911	74,391	653,424	852	295,142.07
1912	125,310	938,678	1,368	429,604.86
1913	175,942	1,127,707	1,652	525,856.64
1914	192,335	1,060,288	1,804	527,861.64
1915	202,659	1,078,863	2,001	553,900.10
1916	221,566	1,189,828	1,862	612,935.72

The service was very rapidly extended, the greatest growth being made in the early years of the service. Since 1913 the rate of increase in the number of cases and visits has declined. This, as we shall see later, is in large part indicative of a better administrative control of the service. The Company has concentrated attention more and more upon obtaining the type of case best adapted to visiting nurse work in life insurance. The high water mark in the number of cases visited and visits made was in the fiscal year 1916, the figures being 221,566 and 1,189,828 respectively. The total annual cost has continuously increased in spite of the decrease in the number of visits between 1913 and 1915. This increase in the unit cost per visit is due to the necessarily increased charges made by associations, the increasing cost of supervision which the Company has instituted, and the general rise of incidental overhead charges.

This rapid growth has been made possible in the first place because of the wide extension of public health nursing associations in many sections of the country. The work of the National Organization for Public Health Nursing has been most commendable in opening up new areas. In the second place the traveling field supervisors of the Company have encouraged the organization of nursing associations in communities where such societies did not exist. The town and country nursing service of the American Red Cross, the statewide development of public health nursing by state boards of health, as in Ohio, and the coöperative arrangements for state organization of public health nursing between the Company and the state boards of health, as in North Carolina and in Virginia, are also very significant factors in the extension of public health nursing in the United States. The general policy of the Company is to employ existing public health nursing societies and associations, and newly founded organizations are accepted where practicable as soon as their work reaches the standards required by the Company. In a total of 843 services in 1916, nearly 500 were under the auspices of nursing associations; the rest, mostly in smaller communities which have no nursing associations, were in charge of the Company's individual nurses employed under contract either on a salary or on a visit basis. As in the nursing associations, these individual nurses of the Company with but few exceptions were required to be graduate nurses. It is a rule of the service that the standards maintained by the National Organization for Public Health Nursing shall be maintained, as far as possible, wherever the Company has jurisdiction.

ADMINISTRATIVE PROGRAMME.

From the beginning, the Company has endeavored to limit its public health nursing to diseases and conditions that have been demonstrated to yield the largest practical returns. The viewpoint has been that the service should be given to cases of acute illness, of accidents, and of after care of childbirth. Only secondarily was the service intended for the care of chronic diseases, and for the care of the acute stages of the chronic diseases. The Company has also insisted that the service shall be given and continued under medical supervision. It is, therefore, required that, after the initial visit, there shall be a physician in attendance in every case. In such cases as are found to be without physician, nurses are instructed to make every effort to bring a physician into the case and where they do not succeed, the case is at once closed. Finally, in a large group of cases not adapted to public health nursing, hygienic advice is given or arrangements are made for transfer to institutional care as indicated by circumstances in each case. These administrative rulings result in the following main division of cases according to the type of service given.

TABLE II.

NUMBER AND PERCENTAGE OF CASES IN MAIN CLASSES OF VISITING NURSE SERVICE—1916, 1915, 1914 COMPARED.

Class of Service	1916		1915		1914	
	No. of Cases	Per cent. of Total	No. of Cases	Per cent. of Total	No. of Cases	Per cent. of Total
Total service	217,422*	100.0	202,653*	100.0	188,154*	100.0
With phys. in attendance	186,821	85.9	174,806	86.3	163,534	86.9
Nursed	*137,865*	*63.4*	*125,530*	*61.9*	*111,959*	*59.5*
Advised	*32,768*	*15.1*	*33,388*	*16.5*	*33,504*	*17.8*
Not nursed	*16,188*	*7.4*	*15,888*	*7.8*	*18,071*	*9.6*
Without phys. in attendance	27,469	12.6	24,903	12.3	21,196	11.3
Nursed	*4,938*	*2.3*	*4,708*	*2.3*	*4,607*	*2.4*
Advised	*16,607*	*7.6*	*14,507*	*7.2*	*10,129*	*5.4*
Not nursed	*5,924*	*2.7*	*5,688*	*2.8*	*6,460*	*3.4*
Non-policyholders	3,132	1.4	2,944	1.5	3,424	1.8

* These figures are for the calendar years 1916, 1915 and 1914 and not for the fiscal years ending November 30, as in Table I.

The first five years of the operation of the service were given over to reaching as large a proportion of the Company's policyholders in the United States and Canada as possible. The last three years comprised in this review were devoted to increasing the efficiency of the Company's public health nursing. This programme consisted of strict application to such important matters as the coöperation of the Company's agency staff in securing the proper types of cases, educating visiting nurses in practical case management, obtaining discharge of cases to institutional care where such measures were indicated, and developing proper after-care for women in childbirth.

Thus, during the period 1914 to 1916 there was a decided increase in the percentage of cases actually nursed with physicians in attendance. In 1914, 59.5 per cent. of the total service was extended to cases which required nursing, and where there was a physician in attendance. In 1916, 63.4 per cent. of the total cases in the service were nursed under medical observation. There was a decided decline in the ratio of advisory service, from 17.8 per cent. of the total cases in 1914 to 15.1 per cent. in 1916. Cases which required no nursing were reduced in the service reports from 9.6 per cent. of the total in 1914 to 7.4 per cent. in 1916.

There was an increase in the proportion of all cases without physician in attendance, from 11.3 per cent. in 1914 to 12.6 per cent. in 1916. This increase is very largely accounted for by the rise in the proportion of cases of advisory service. Since these cases involve for the very largest number only one inspection visit this tendency toward increase is not very significant.

CLASSES OF PERSONS NURSED.

The persons reached by the Company's Visiting Nurse Service were very largely members of the wage-earning groups of the population, and the greater proportion of them, 87 per cent. in 1916, were white. The percentage of colored persons for the same year was 13 per cent. This is in fairly close agreement with the proportion of the two races in the general group of the Company's policyholders. Without distinction of color, 25 per cent. of the persons were males and 75 per cent. were females in the Visiting Nurse Service experience of 1916. The proportion of males in the general group of policyholders is considerably higher, however. This preponderance of nursing work among females has been observed by visiting nurse associations generally and is accounted for in the Metropolitan service by the large number of maternity cases. The aim of the service is to reach year by year an increasingly large number of males who today do not come within its scope. The Visiting Nurse Service reaches nearly twice the number of children under five than would be indicated by their proportionate representation in the entire group of policyholders. This may well be due to the very high sickness rates which prevail among children under five, particularly from the diarrheal and the communicable diseases. On the other hand, there are less than half as many patients relatively represented in the service between ten and nineteen years as there are policyholders for the same age period. For the adult ages twenty and over there is fairly close agreement between the proportion of patients and the proportion of policyholders.

The following table presents a comparison of the age characteristics of patients reached by the service, and of policyholders.

TABLE III.

PER CENT. DISTRIBUTION OF PATIENTS AND POLICYHOLDERS BY AGE PERIOD IN 1916.

Age Period	Patients, Per cent. of Total	Policyholders, Per cent. of Total
All ages	100.0	100.0
Under 5	16.4	8.4
5–9	11.9	13.5
10–14	5.7	11.9
15–19	4.8	11.0
20–39	35.3	32.4
40–59	18.0	17.4
60 and over	7.9	5.3

DISEASES AND CONDITIONS IN THE VISITING NURSE SERVICE OF 1916.

Considering only the 214,290 policyholders visited by the service during the calendar year 1916,* there are available a number of observations on the character of the diseases and conditions entering into the entire experience. Thus, typhoid fever was visited in 4,137 cases or 1.9 per cent. of the total. Malaria, a disease of the first importance as a public health problem in the South, was visited in 3,556 cases or 1.7 per cent. of the total cases in the service. Measles was reported in 5,348 cases or 2.5 per cent. The cases of the other communicable diseases of children did not constitute a considerable proportion of the service experience. Influenza was visited in 15,818 cases or 7.4 per cent. of the total recorded for the year. Tuberculosis of the lungs still constitutes quite a significant proportion of the cases. Of this disease there were 4,145 cases visited during the year or in 1.9 per cent. of the total service. Rheumatism accounted for 5,060 cases or 2.4 per cent. of the total. This term is used to describe a number of separate diseases and conditions simulating "rheumatism," and is perhaps as satisfactory a designation as can be secured from the types of cases available in the service. Colds, coryza and rhinitis were represented in 5,300 cases or in 2.5 per cent. of the total service. Bronchitis was recorded in 6,484 cases or 3.0 per cent. of the total. Broncho and lobar pneumonia together accounted for 11,988 cases or 5.6 per cent. of the total service. Tonsillitis was another important element in the service, accounting for 8,146 cases or 3.8 per cent. of the total. Aftercare in childbirth was recorded in 23,896 cases or 11.2 per cent. of the total cases visited. Accidents and injuries were reported in 16,500 cases or 7.7 per cent. of the total service. Of this number, 2,948 were burns, representing 1.4 per cent. of the total service; 2,903 were fractures or 1.4 per cent. of the total cases and 3,763 were wounds of various kinds or 1.8 per cent. of the total. In the foregoing classification we have followed strictly the practice of Bellevue and Allied Hospitals and the figures thus shown are comparable with any compiled by that hospital or by other institutions employing the same classification. The foregoing facts are set forth in some detail in the following table:

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*There were 3,132 non-policyholders included in the total service figures in the preceding tables. We have isolated this group from the medical statistics of the service.

TABLE IV.

PRINCIPAL DISEASES AND CONDITIONS IN ENTIRE VISITING NURSE SERVICE, 1916.

Disease or Condition	Number of Cases	Per Cent. of Total
All diseases and conditions	214,290	100.0
General diseases	51,569	24.1
Typhoid fever	4,137	1.9
Malaria	3,556	1.7
Measles	5,348	2.5
Scarlet fever	885	.4
Whooping cough	1,737	.8
Diphtheria and croup	1,263	.6
Influenza	15,818	7.4
Other epidemic diseases	3,049	1.4
Purulent infection and septicemia	750	.3
Tuberculosis of the lungs	4,145	1.9
Other forms of tuberculosis	1,113	.5
Cancers and other malignant tumors	1,958	.9
Rheumatism	5,060	2.4
Other general diseases	2,750	1.3
Diseases of nervous system and organs of special sense	10,313	4.8
Cerebral hemorrhage, apoplexy, paralysis	2,424	1.1
Neuralgia and neuritis	1,610	.8
Diseases of the eyes and their annexa	1,358	.6
Diseases of the ears	1,763	.8
Other diseases of nervous system	3,158	1.5
Diseases of the circulatory system	6,380	3.0
Organic diseases of the heart	2,457	1.1
Diseases of the veins	1,746	.8
Diseases of the lymphatic system	1,197	.6
Other diseases of the circulatory system	980	.5
Diseases of the respiratory system	27,501	12.8
"Colds," coryza and rhinitis	5,300	2.5
Bronchitis	6,484	3.0
Bronchopneumonia	2,470	1.2
Pneumonia (lobar and undefined)	9,518	4.4
Pleurisy	1,931	.9
Other diseases of the respiratory system	1,798	.8
Diseases of the digestive system	28,976	13.5
Tonsillitis	8,146	3.8
Diseases of the stomach	5,902	2.8
Diarrhea and enteritis (under 2 yrs.)	2,017	.9
Diarrhea and enteritis (2 yrs. and over)	3,655	1.7
Appendicitis	2,928	1.4
Other diseases of the digestive system	6,328	3.0
Non-venereal diseases of the genito-urinary system	11,575	5.4
Acute nephritis	455	.2
Bright's disease	2,023	.9
Other diseases of the kidneys	454	.2
Salpingitis and other diseases of female genital organs	2,229	1.0
Other non-venereal diseases of the genito-urinary system	6,414	3.0
The puerperal state	41,572	19.4
Abortions and miscarriages	3,469	1.6
Other accidents of pregnancy	483	.2
Pregnancy only	7,459	3.5
Pregnancy and aftercare	1,552	.7
Aftercare only	23,896	11.2
Puerperal septicemia	967	.5
Puerperal albuminuria and convulsions	308	.1
Other diseases and conditions of the puerperal state	3,438	1.6
Diseases of the skin	5,068	2.4
Diseases of the bones and organs of locomotion	2,394	1.1
External causes	16,500	7.7
Burns	2,948	1.4
Contusions	1,714	.8
Dislocations	246	.1
Fractures	2,903	1.4
Sprains	1,738	.8
Wounds	3,768	1.8
All other external causes	3,188	1.4
All other diseases and conditions	11,566	5.4
No illness	876	.4

GENERAL TENDENCY OF THE AVERAGE AMOUNT OF SERVICE.

The entire Visiting Nurse Service in the calendar year 1916 made precisely the same average number of visits as in 1915; namely, 5.5 visits per case. Considering only cases visited where there was a physician in attendance, the nursed cases registered the same average number of visits per case, 8.0 for both years; advised cases continued to show a decrease in the average number of visits per case. In 1914 the figure for advised cases having medical attendance was 2.0; the average number of visits for such cases was reduced to 1.3 in 1916. Cases visited with physician in attendance, but where neither advisory nor nursing service was indicated, showed 1.1 visits per case in 1916. These are very nearly always genuine cases of illness where the nurse is called upon to facilitate the removal of the patient to some institution or where the family is giving the patient proper attention. The following table displays the general tendency of the average amount of visiting nurse service extended to the main classes represented in the service reports:

TABLE V.

AVERAGE NUMBER OF VISITS PER CASE, MAIN CLASSES OF VISITING NURSE SERVICE IN 1916, 1915 AND 1914.

Class of Service	1916	1915	1914
All classes	5.5	5.5	5.8
With physician in attendance:			
Nursed	8.0	8.0	8.5
Advised	1.3	1.5	2.0
Not nursed	1.1	1.1	1.2

DURATION OF THE AVERAGE CASE.

One of the factors of case management in public health nursing is proper discharge of the case when the services of the nurse are no longer actually needed. The available statistics indicate that the Company's efforts in this direction have been productive. In part, the reduction in the duration of the average case for the entire service was due to the shifting of the classes of cases served and through necessary and desirable restrictions of the service. These important features of the service are shown in the following table:

TABLE VI.

AVERAGE DURATION OF CASES IN DAYS, MAIN CLASSES OF VISITING NURSE SERVICE OF 1916, 1915 AND 1914.

Class of Service	1916	1915	1914
All classes	9.0	9.7	13.0
With physician in attendance:			
Nursed	13.0	13.9	18.3
Advised	2.4	4.2	7.7
Not nursed	1.4	1.5	2.3

A glance at the above figures indicates that the service in its main characteristics is tending toward stability. The rate at which the duration of the average case is being reduced was much less in 1916 than in 1915. Thus, for nursed cases showing medical attendance, only one day was taken off the average in 1916 as compared with a reduction of four days during 1915 over the figure for the previous year. Advisory service showed a reduction to 2.4 days in 1916 from 4.2 days in 1915; in 1914 advised cases showed an average of 7.7 visits.

INCREASING THE FREQUENCY OF VISITS TO THE AVERAGE CASE.

Another factor in practical case management is the proper choice of cases and of the proper types, or stages, of certain diseases or conditions, especially chronic diseases. It is also of importance to increase the frequency of visits in the course of an acute case, during a pneumonia crisis, for instance. Constant emphasis upon these significant factors has produced appreciable shortening in the average time between visits. A considerable period in between visits would indicate probably that the service was not getting the acute types of cases in which actual nursing accomplishes the greatest results. Thus, while in 1914 a visit was made for the entire service, once every 2.2 days, in 1916 the average case received one visit every 1.6 days. This is one index that more suitable cases are being referred to the nurses and that cases receive nursing care more frequently during critical periods. The service to advisory cases was also intensified, from one visit every 3.8 days to one visit every 1.9 days. The foregoing facts are set forth in the following table.

TABLE VII.

NUMBER OF DAYS BETWEEN VISITS TO THE AVERAGE CASE, MAIN CLASSES OF VISITING NURSE SERVICE OF 1916, 1915 AND 1914.

Class of Service	1916	1915	1914
All classes	1.6	1.8	2.2
With physician in attendance:			
Nursed	1.6	1.8	2.2
Advised	1.9	2.9	3.8
Not nursed	1.3	1.4	1.8

RESULTS IN SECURING PROPER TYPES OF CASES.

A few additional figures give further reliable indications of the trend of the principal elements of the service. We computed an index figure for "acute service," "chronic service," and "maternity service." For each of the years 1914, 1915 and 1916 we selected the same group of diseases which had respectively, "acute" or "chronic" characteristics. The total amount of maternity service was also ascertained for each of the three years. The number of cases registered in each of these "acute," "chronic" or "maternity" groups was related to the total number of cases nursed with physician in attendance, and the index was expressed as a percentage. These indexes are shown in the following table:

TABLE VIII.

CHANGES IN INDEXES OF "ACUTE," "CHRONIC" AND "MATERNITY" NURSING.

Type of Nursing	1916	1915	1914
Acute diseases	29.8	28.1	26.9
Chronic diseases	9.1	10.2	11.8
Maternity cases	21.9	21.1	20.2

Thus the service to acute cases increased by nearly 3 per cent.; service to chronic cases showed a substantial decrease; and maternity service increased from 20.2 per cent. in 1914 to 21.9 per cent. in 1916.

It may be of interest also to observe the trend of the facts for the several diseases and conditions classified under the three foregoing broad groups of service. Under acute service, typhoid fever showed a significant decline in its percentage.

The four communicable diseases of children, however, increased from 2.5 per cent. of the total cases nursed with physician in attendance to 3.0 per cent. Influenza, on account of the widespread epidemic during the early part of 1916, increased from 4.6 per cent. to 7.5 per cent. Pneumonia showed an increase also from the figure recorded in 1914.

Tuberculosis of the lungs showed a decline in percentage from 3.2 per cent. to 2.0 per cent. between 1914 and 1916. The percentage of cancer declined from 1.3 per cent. to 1.2 per cent.; rheumatism was registered in 3.5 per cent. of the cases in 1914 and only 2.6 per cent. in 1916. Bright's disease and organic diseases of the heart also showed declines between 1914 and 1916. These facts are shown in greater detail in Table IX.

CONDITION OF PATIENTS ON DISCHARGE.

We believe our statistics on condition of discharge to be fairly reliable only for the two years 1915 and 1916. During 1914 we began to emphasize more and more the necessity for uniform modes of stating the conditions of patients on discharge. In 1915 our experience with the records returned to the office was such as to warrant our conclusion that the figures for that year would be fairly useful. Table X following shows the percentages for the several conditions on discharge for the entire Visiting Nurse Service in 1915 and in 1916 and for the nursed and advised cases where there was medical attendance.

TABLE IX.

COMPARISON OF RESULTS FOR CASES NURSED WITH PHYSICIAN IN ATTENDANCE, VISITING NURSE SERVICE OF 1914, 1915, 1916.

(Principal Diseases and Conditions Distinguished for General Types of Nursing.)

Type of Nursing and Disease or Condition	1916					1915					1914				
	Number of Cases	Per Cent. of Total	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Number of Cases	Per Cent. of Total	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Number of Cases	Per Cent. of Total	Av. Visits per Case	Av. Days per Case	Av. Days per Visit
Acute service:															
Typhoid fever...........	3,710	2.7	14.0	18.4	1.3	3,454	2.8	13.6	18.2	1.3	3,759	3.4	13.2	18.4	1.4
Four comm. diseases of children..............	4,140	3.0	5.8	10.0	1.7	3,228	2.6	6.3	11.7	1.8	2,775	2.5	6.4	13.7	2.1
Influenza...............	10,376	7.5	5.5	8.9	1.6	7,735	6.2	5.1	8.7	1.7	5,100	4.6	5.5	11.6	2.1
Diseases of the eyes......	713	.5	7.8	14.0	1.8	673	.5	7.9	14.3	1.8	714	.6	7.9	17.6	2.2
Diseases of the ears	1,187	.9	8.0	13.3	1.7	960	.8	7.3	13.5	1.8	930	.8	8.1	15.8	1.9
Pneumonia—all forms	10,188	7.4	9.0	11.7	1.3	9,475	7.5	8.8	11.7	1.3	7,868	7.0	8.6	12.8	1.5
Pleurisy................	1,520	1.1	8.9	14.3	1.6	1,419	1.1	8.6	14.3	1.7	1,233	1.1	8.0	15.0	1.9
Tonsillitis..............	4,857	3.5	4.1	6.5	1.6	4,318	3.4	4.1	6.5	1.6	4,085	3.6	4.2	7.6	1.8
Appendicitis.............	2,230	1.6	8.4	14.1	1.7	2,062	1.6	8.1	13.7	1.7	1,823	1.6	7.9	14.9	1.9
External causes:															
Burns................	2,169	1.6	12.3	19.2	1.6	2,070	1.6	11.7	18.6	1.6	1,862	1.7	11.6	19.9	1.7
Chronic service:															
Tuberculosis of the lungs..	2,771	2.0	10.4	26.2	2.5	3,249	2.6	11.3	36.6	3.2	3,615	3.2	13.2	72.4	5.5
Cancer.................	1,617	1.2	14.4	27.1	1.9	1,635	1.3	13.4	27.0	2.0	1,510	1.3	16.8	38.0	2.3
Rheumatism............	3,572	2.6	9.9	18.9	1.9	3,362	2.7	9.5	19.5	2.0	3,927	3.5	10.3	25.5	2.5
Diseases of the veins (varicose veins, hemorrhoids)	1,304	.9	10.9	23.0	2.1	1,226	1.0	11.0	31.6	2.9	1,183	1.1	12.3	30.4	2.5
Bright's disease..........	1,583	1.1	9.9	18.2	1.8	1,463	1.2	10.2	19.8	2.0	1,430	1.3	11.0	26.2	2.4
Organic diseases of the heart	1,855	1.3	10.3	20.5	2.0	1,741	1.4	10.0	21.8	2.8	1,552	1.4	11.2	28.0	2.5
Maternity service:															
Accidents of pregnancy ...	3,257	2.4	6.7	9.1	1.4	3,005	2.4	6.7	9.5	1.4	2,666	2.4	6.7	10.6	1.6
Abortions and miscarriages	2,870	2.1	6.6	8.8	1.3	2,643	2.1	6.5	8.8	1.4					
Pregnancy only..........	292	.2	4.0	7.9	2.0	371	.3	5.2	10.9	2.1	15,870	14.2	7.0	10.9	1.6
Pregnancy and after care .	1,424	1.0	8.6	24.9	2.9	1,027	.8	7.1	8.7	1.2					
After care only..........	20,788	15.1	7.1	8.4	1.2	18,133	14.4	7.1	8.7	1.2					
Puerperal septicemia	932	.7	12.8	15.7	1.2	962	.8	13.0	15.9	1.2	952	.9	12.4	17.2	1.4
Puerperal albuminuria....	271	.2	11.3	16.6	1.5	269	.2	11.2	17.6	1.6	258	.2	10.9	21.9	2.0
Other dis. of puerperal state	3,225	2.3	10.3	13.7	1.3	2,700	2.2	10.3	14.1	1.4	2,846	2.5	10.4	16.3	1.6

TABLE X.

CONDITION OF PATIENTS ON DISCHARGE FROM VISITING NURSE SERVICE, 1916 AND 1915.

Condition on Discharge	Entire Service				Nursed Cases with Physician in Attendance				Advised Cases with Physician in Attendance			
	1916		1915		1916		1915		1916		1915	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
All cases discharged..........	214,290	100.0	199,709	100.0	137,865	100.0	125,530	100.0	32,768	100.0	33,388	100.0
Recovered	55,203	25.8	41,265	20.7	47,345	34.3	36,200	28.8	2,923	8.9	2,116	6.3
Improved.................	103,275	48.2	104,868	52.5	69,519	50.4	69,700	55.5	15,785	48.2	17,617	52.8
Unimproved...............	34,019	15.9	30,726	15.4	13,083	9.5	12,102	9.6	10,208	31.2	9,160	27.4
Dying....................	347	.2	......	.....	257	.2	......	.....	29	.1	......	.....
Dead.....................	6,403	3.0	6,863	3.4	5,743	4.2	5,945	4.7	190	.6	363	1.1
Unspecified..............	15,043	7.0	15,987	8.0	1,918	1.4	1,583	1.3	3,633	11.1	4,132	12.4

In 1916 a little over one fourth of all cases (25.8 per cent.) were discharged as recovered. In addition, nearly one half (48.2 per cent.) were discharged as improved; together 74 per cent. were discharged as either recovered or improved. An additional 15.9 per cent. were unimproved. A little over 3 per cent. were discharged as dead or dying and the residual 7 per cent. were unspecified as to their condition on discharge. On comparing these figures with the corresponding ones for 1915, we find an increase in 1916 of 5 per cent. in the recovered cases with a decrease of nearly the same figure in the proportion of improved cases.. We would suggest that these differences are complimentary in character and result from the effort made to standardize the use of the terms "recovered," "improved," etc. among the various nursing associations. A large number of cases which were reported as "recovered" in 1916 would undoubtedly have been registered as "improved" in the previous year. The other sets of figures show very slight differences, indicating that the service has reached a fairly fixed status as to the condition of the patients at the time of discharge. The decline in the percentage of cases reported as "unspecified" as to condition is, of course, gratifying since it indicates that greater care is now being taken by the nurses to specify the condition of the patient at the time of discharge.

As might be expected a larger proportion of cases were reported as recovered and improved in the group of cases nursed with physician in attendance than was found in the entire service. Together 84.7 per cent. were so discharged in 1916. A correspondingly smaller proportion of cases were discharged as "unimproved" than was found in the entire service. The proportion of "dead and dying" at the time of discharge was higher than in the entire service for the reason that the nursed cases are more likely to be carried on until the cases are closed by recovery or death. The proportion of cases "unspecified" as to condition on discharge was very low indeed, only 1.4 per cent.

PRACTICAL RESULTS IN NURSING AND CASE MANAGEMENT OF INDIVIDUAL DISEASES.

We have viewed generally the experience of the year 1916. Let us now inquire into the practical results of the year for a number of the particular diseases and conditions in comparison with the facts for the service for the two preceding years. By presenting these detailed facts we shall endeavor to show the probable effect of our programme to standardize the methods and policies of insurance public health nursing since 1914.

I. ACUTE DISEASES.

In a preceding section we observed that the relative amount of nursing in acute diseases had increased since we first started to emphasize the necessity for having a larger proportion of such cases in our work. The following remarks on the particular diseases will deal with this point at some length.

Typhoid Fever.

Typhoid fever is admittedly a disease in which excellent results have been achieved by visiting nursing. This fact is all the more significant when one considers that communities with poor facilities for institutional care of the disease are just as likely to have high typhoid fever incidence resulting from deficient means for safeguarding the public health against infection. Some effective means of nursing the disease and of protecting the members of households, in these communities especially, must be found. The practical experience of the Metropolitan justifies confidence in visiting nursing as one agency for the proper care of the disease.

In 1916, there were 3,710 cases of typhoid fever actually nursed with physician in attendance. The detailed facts of our experience with this disease over the three-year period 1914 to 1916 are shown in the following table:

TABLE XI.

TYPHOID FEVER NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	3,710	3,454	3,750
Per cent. of total nursed	2.7	2.8	3.4
Average visits per case	14.0	13.6	13.2
Average days per case	18.4	18.2	18.4
Time between visits (days)	1.3	1.3	1.4
Percentage recovered and improved	80.8	80.8	81.6
Percentage unimproved	15.3	14.9	12.8
Percentage dead	4.0	4.2	5.5
Percentage trans. to institutional care	19.2	17.7	15.2

The percentage of typhoid fever in the total nursed cases declined from 3.4 to 2.7 in three years. There was a slight increase in the average number of visits per case; the average duration of nursing remained practically the same; the time between visits was slightly shortened. The increase in the percentage of cases discharged as "unimproved," and the decrease in the ratio of deaths per 100 cases are probably due to the increased number and proportion of cases transferred to institutional care. The shortening of the time between visits may also have had some influence upon the bettering of the lethal rate* of this disease among our cases.

The value of modern visiting nursing treatment in typhoid fever is no longer open to question. Attention need only be directed to the remarkable improvement which has occurred in recent years in the death rates from typhoid fever in the industrial mortality experience of the Metropolitan Life Insurance Company. In 1911, 22.8 deaths occurred from typhoid fever per 100,000 persons exposed; in 1916, this rate had decreased to 13.0 per 100,000 or a reduction of 43 per cent. in 6 years. This favorable showing has resulted from the many activities centered on the control of typhoid fever, such as the purification of water supplies, the better control of sewerage in cities, the medical examination of food handlers and the inspection of foods. In addition, the evidence shows clearly that the visiting nurse work of the Company for its industrial policyholders has also played its part; for the relative reduction in the typhoid mortality experience of the Company's industrial department is higher than that for the Registration Area, with which experience it may be compared.

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*Lethal rate = number of deaths per 100 cases.

Visiting nursing in typhoid fever must also affect favorably the mortality rates from other diseases in the future. As has been pointed out in a report* issued by this Company, the complications of typhoid fever result in a high mortality in the years following recovery. Visiting nursing is effective in not only averting complications but also in reducing the number of secondary cases which ordinarily would occur in the immediate families of the patients. Altogether it must be conceded that visiting nursing today has one of its great opportunities in decreasing the case mortality of the disease, in disseminating information on the management of typhoid fever in the home and finally in bringing its collections of facts on typhoid fever prevalence to the attention of the health agencies which control the disease at its source.

Four Communicable Diseases of Children.

The following table shows the number and proportion of each of the four communicable diseases included in the total which will later be discussed in detail:

TABLE XII.

NUMBER AND PERCENTAGE OF FOUR COMMUNICABLE DISEASES OF CHILDREN IN 1916 NURSING EXPERIENCE; CASES WITH PHYSICIAN IN ATTENDANCE.

Communicable Diseases of Children	Number of Cases	Per Cent. of Total Four Communicable Diseases of Children
Total	4,140	100.0
Measles	2,442	59.0
Scarlet fever	437	10.6
Whooping cough	656	15.8
Diphtheria and croup	605	14.6

Measles accounted, therefore, for very nearly six-tenths of the cases to which we shall hereafter refer as "four communicable diseases of children."

For these diseases combined we registered 4,140 cases in 1916. There was a decided increase during 1916 in the percentage of such cases in the total service, due probably to the epidemic of measles which prevailed rather generally in the United States throughout the spring of 1916. For the group, the average number of visits was reduced, the average period of nursing and the time between visits were shortened. These facts are shown in the following table:

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* Dublin, Louis I., "Typhoid Fever and its Sequelae." Metropolitan Life Insurance Co., 1914.

TABLE XIII.

NURSING EXPERIENCE WITH FOUR COMMUNICABLE DISEASES OF CHILDREN, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	4,140	3,228	2,775
Per cent. of total nursed	3.0	2.6	2.5
Average visits per case	5.8	6.3	6.4
Average days per case	10.0	11.7	13.7
Time between visits (days)	1.7	1.8	2.1
Percentage recovered and improved	82.7	82.5	82.7
Percentage unimproved	13.1	13.6	13.0
Percentage dead	4.2	4.0	4.3
Percentage trans. to institutional care	10.1	9.4	8.5

The nursing of the communicable diseases of children is obviously as yet an undeveloped part of visiting nurse work. The number of cases will probably increase as the administrative opinion in regard to what constitutes safe nursing in these cases becomes more liberal. There is already a strong tendency to assume that these diseases may be properly cared for by general visiting nurses without endangering the health of other patients under the care of such nurses. The problem of cross-infection in connection with the nursing care of these diseases is one which should be approached on the basis of the established facts of experience. This subject will be further considered in relation to the work of the principal associations.

Malaria

In 1916 we nursed 2,466 cases which were reported as malaria. While this disease is relatively of minor importance in the entire service, it plays a large part in the public health nursing programme for the Company's policyholders in the southern states. In these areas malaria still prevails, in some sections at least, to a very disquieting extent.

There is under way an intelligently conceived programme for the reduction of the conditions which give rise to malaria incidence in the South. The effort of the Company to be of service in this movement for the practical control of the disease is indicated by the following table, giving the number of cases nursed or advised with physician in attendance, in leading southern services during 1916:

TABLE XIV.

NUMBER AND PERCENTAGE OF MALARIA CASES NURSED AND ADVISED WITH PHYSICIAN IN ATTENDANCE IN LEADING SOUTHERN SERVICES, 1916.

City	Number of Cases	Per Cent. of all Diseases	Average Visits per Case
Birmingham, Ala.	73	9.8	4.5
Augusta, Ga.	71	17.4	5.6
Columbus, Ga.	149	15.5	5.1
Savannah, Ga.	133	22.6	3.1
New Orleans, La.	43	2.7	3.2
Charlotte, N. C.	14	3.9	4.4
Chattanooga, Tenn.	46	6.9	5.7
Memphis, Tenn.	583	26.5	3.6
Nashville, Tenn.	81	7.8	4.3
Norfolk, Va.	34	5.2	7.7

The foregoing table represents only those services in the South where malaria constituted a significant proportion of the total cases. There were other southern areas with equally large populations where the number of cases of malaria in our nursing experience was very small indeed. This indicates a variable distribution of the disease throughout the several distinct geographic areas of the South. In general, the cities located in the Appalachian Plateau and in the adjacent upland country, show a lower incidence of malaria than do the cities on the Atlantic and Gulf coastal plain or in the Mississippi valley.

The 2,466 cases of malaria nursed with physician in attendance during 1916 constituted 1.8 per cent. of the entire nursed cases. An average of 5.5 visits was made per case. The average duration of nursing care, 8.4 days, shows a reduction from the figure of 11.5 days recorded in 1914. The frequency with which visits were made also changed. In 1914 a visit was made once every 2.1 days; in 1916 the average malaria case was visited once in 1.5 days. These changes in these ratios indicate that we are perhaps getting more cases of malaria in the seriously acute stages. There was a decided decline in the percentage of malaria cases transferred to institutional care.

TABLE XV.

MALARIA NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	2,466	2,482	2,020
Per cent. of total nursed	1.8	2.0	1.8
Average visits per case	5.5	5.4	5.5
Average days per case	8.4	9.3	11.5
Time between visits (days)	1.5	1.7	2.1
Percentage recovered and improved	96.7	97.2	96.5
Percentage unimproved	2.5	2.0	2.4
Percentage dead	.8	.9	1.2
Percentage trans. to institutional care	3.5	4.7	5.3

Influenza.

The epidemic of influenza, or of grippe-like infections of the respiratory tract which prevailed very generally over the United States during the later part of 1915 and the early months of 1916, left its distinct imprint upon the nursing experience of the service.

TABLE XVI.

INFLUENZA NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	10,376	7,735	5,100
Per cent. of total nursed	7.5	6.2	4.6
Average visits per case	5.5	5.1	5.5
Average days per case	8.9	8.7	11.6
Time between visits (days)	1.6	1.7	2.1
Percentage recovered and improved	95.3	95.9	96.0
Percentage unimproved	3.6	3.2	2.9
Percentage dead	1.1	.8	1.1
Percentage trans. to institutional care	6.0	5.8	4.5

There were more than twice as many influenza cases in the experience of 1916 than were recorded in 1914. The average number of visits per case remained practically stationary, but the average number of days of nursing was reduced in the three year period from 11.6 to 8.9. The time between visits was shortened from 2.1 to 1.6 days; this latter figure indicates more intense service and perhaps demonstrates that the cases represented in the epidemic were of serious nature. This coincides with the clinical experience generally during the course of the epidemic. The distinctly higher death rates from influenza and from influenzal pneumonia in our industrial experience for the year 1916 support this contention.

Broncho- and Lobar Pneumonia.

It would be very desirable in this discussion to distinguish between the two main types of pneumonia, namely, broncho- and lobar. Unfortunately, the data were not definite enough in a sufficiently large number of the records to make it possible. In 1916, there were only 2,166 cases of bronchopneumonia so specified, nursed with physician in attendance, and 8,022 additional cases of pneumonia (lobar and undefined), making a total of 10,188 cases. In view of the large number of children nursed for these conditions, the true number of cases of bronchopneumonia must have been much larger. The composite treatment, however, will not be misleading because the various types of pneumonia require very similar nursing care. The figures at our disposal show much the same average number of visits per case, average duration per case, average days between visits as well as other similar characteristics of service for both forms of pneumonia.

Our nursing experience appears to indicate that of all the diseases and conditions which receive nursing care, pneumonia yields perhaps the largest practical results for the effort expended. Pneumonia nursing requires the same careful regard for the details of bedside treatment, the hygiene of the sickroom and the education of the members of the household as are indicated for typhoid fever. Apparently the same gratifying response to intensified nursing care is observed in our records for pneumonia as for the other diseases. In fact there is a well established current impression that the visiting nurse care of pneumonia in the home, especially with children, ultimately achieves better results than hospitalization of the disease. The statistical evidence in support of this statement is not at present entirely conclusive; from such data as are available, however, we may readily conclude that home nursing care of children sick with pneumonia is increasingly effective.

In 1916 there was an increase in the number of cases of pneumonia nursed with physician in attendance. The 10,188 cases of this type constituted 7.4 per cent. of the total nursed cases. In the previous year the proportion was 7.5 per cent. of all the cases. Epidemic conditions prevailed in both years.

TABLE XVII.

PNEUMONIA NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	10,188	9,475	7,868
Per cent. of total nursed	7.4	7.5	7.0
Average visits per case	9.0	8.8	8.6
Average days per case	11.7	11.7	12.8
Time between visits (days)	1.3	1.3	1.5
Percentage recovered and improved	83.7	83.7	84.7
Percentage unimproved	8.4	8.2	7.4
Percentage dead	7.9	8.1	7.9
Percentage trans. to institutional care	11.0	10.7	16.2

It is in comparison with the figures for 1914 that the more striking differences are found. Thus, since that earlier year the average number of visits per case has increased by one-half visit per case; the average duration of the case has decreased slightly more than one day, the time between visits being thus reduced. The percentage of cases transferred to institutional care has been very considerably reduced from 16.2 to 11.0 per cent. of all the cases. This reduction would seem to indicate that the more serious types of pneumonia which were formerly transferred to hospital care are now carried through to their termination either by recovery or death. It is, therefore, very significant to find that with the smaller percentage of transfers to institutional care there has been no increase in the percentage of cases reported as dead, namely, 7.9 per cent. of all the cases nursed with physician in attendance; the figures being the same for 1914 and 1916. This figure is undoubtedly less than the true lethal rate in pneumonia cases because a number of deaths must have occurred among our cases after they had been discharged by the nurse either to the family or to other institutions. The exact number of such fatal cases will remain unknown until a more elaborate method has been developed to keep track of the condition of patients after the nursing care has been closed. The percentage of unimproved cases is only very slightly increased. All the facts at our disposal clearly indicate that very definite standards for the nursing of pneumonia have been established since 1915 and that these will be maintained.

Diarrhea and Enteritis.

Diarrhea and enteritis were nursed with physician in attendance in 3,970 cases, or in 2.9 per cent. of all cases in 1916. Since there are no significant differences between the nursing characteristics of the disease under and over three years of age, as classified originally in our statistics, the following table, giving the main facts of our nursing experience with diarrhea and enteritis, is presented without distinction of age:

TABLE XVIII.

DIARRHEA AND ENTERITIS NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	3,970	3,424	2,621
Per cent. of total nursed	2.9	2.7	2.3
Average visits per case	6.4	6.3	6.7
Average days per case	9.5	9.6	11.4
Time between visits (days)	1.5	1.5	1.7
Percentage recovered and improved	91.2	89.2	90.7
Percentage unimproved	5.1	5.5	4.3
Percentage dead	3.7	5.2	5.1
Percentage trans. to institutional care	8.2	7.1	3.2

There was an increase in the number and percentage of cases nursed by the service in 1916 over the figures recorded in 1915 and in 1914. The average number of visits per case remained about the same as in 1915 but was lower than in 1914. This fact is attributed largely to improvement in the management of adult cases of the disease. A similarly favorable reduction in the average period of nursing care per case was also accomplished since 1914, more emphatically with adult cases than with children under three years of age next birthday. From the statistics it appears that visits were made with greater frequency during the acute stages of the disease in 1916 than during 1914. Considerably more than twice as many cases proportionately were transferred to institutions for care in 1916 than in 1914. Perhaps this explains the lower proportion of cases reported as dead on discharge.

The fact that in life insurance public health nursing, children under one year of age are not accessible to the nurse, in a measure diminishes the amount of diarrhea and enteritis work which a life insurance company can do. Nevertheless some emphasis upon diarrhea and enteritis nursing as a part of a health conservation programme is decidedly called for, more perhaps by the social factors of the disease than by the immediate problem of case fatality. The incidence of diarrhea and enteritis is a sensitive index of the health standards of communities. The visiting nurse care of the disease itself must be supplemented by public health measures which control its occurrence. For such child policyholders as are within the purview of the Service a substantial reduction in mortality has been accomplished. During the period 1911 to 1916 a reduction of 5.7 per cent. was achieved in diarrhea and enteritis mortality. Such reduction may be expected to result from visiting nursing measures which do much to diminish the severity of the attack and the consequent fatality rate of the disease.

Accidents and Injuries.

Accidents and injuries present the same general nursing characteristics as the acute diseases. Our figures for this class of service are interesting because we have a large number of such cases and because they bring us in touch with a considerable number of male policyholders. In fact, the accidents and injuries are the chief conditions recorded among the male policyholders reached by the Service.

During 1916, 16,500 cases of accidents and injuries were visited. Of this number, 11,038 or 66.9 per cent. were actually nursed under the direction of a physician. The remaining cases were advisory in character or were not actively nursed because of the absence of a physician. These averaged only a little more than one visit per case, indicating that the nurses were able either to effect a transfer of such cases to institutional care or to secure other provision for the welfare of the injured patients. We shall, therefore, limit our extended discussion of this group of accident cases to those actually nursed with a physician in attendance.

The following table shows the experience of the Service with accident and injury cases nursed with physician in attendance, during the period 1914 to 1916:

TABLE XIX.

NURSING EXPERIENCE WITH EXTERNAL CAUSES, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	11,038	10,917	9,710
Per cent. of total nursed	8.0	8.7	8.7
Average visits per case	9.1	9.0	9.1
Average days per case	16.1	16.1	18.3
Time between visits (days)	1.8	1.8	2.0
Percentage recovered and improved	92.4	92.2	92.1
Percentage unimproved	6.5	6.5	6.6
Percentage dead	1.1	1.3	1.3
Percentage trans. to institutional care	13.3	12.6	11.1

While there was an increase in the actual number of accident and injury cases nursed during 1916 as compared with the previous years, the percentage of such cases to total declined somewhat. There was during 1916 practically a stationary average number of visits per case, 9.1 covering a period of 16.1 nursing days with a visit once every 1.8 days. There was a larger percentage of cases transferred to institutional care during 1916 than during 1915 or 1914. The proportion of recovered and improved cases is extremely high and fairly constant for the three year period. The proportion of those reported as "dead" is extremely low and indicates that these accidents and injuries were for the most part only minor conditions.

In 1916 it was possible for us to adopt a somewhat different mode of classifying the statistics of accidents in the Nursing Service. This consisted in grouping the cases to show the effect of the accidents, that is, whether they were burns, contusions, fractures, and other specific injuries. Formerly, the accident data were classified mainly according to means of injury, that is, whether the injury was affected by falling, by machinery, by cutting or piercing instruments, etc. This new classification of the accident cases makes it possible for us to compare our findings essentially with the published reports of hospitals and other institutions employing the Bellevue and Allied Hospitals classification, which is indeed the one we adopted in our work. The following table shows the number of cases recorded for each type of injury:

TABLE XX.

NUMBER AND PERCENTAGE OF SPECIFIED INJURIES IN TOTAL ACCIDENTS AND INJURIES REPORTED BY VISITING NURSE SERVICE DURING 1916.

Injury	Number	Per Cent.
Total	16,500	100.0
Burns	2,948	17.9
Contusions	1,714	10.4
Dislocations	246	1.5
Fractures	2,903	17.6
Sprains	1,738	10.5
Wounds	3,763	22.8
All other and unclassified injuries	2,242	13.6
All other unspecified external causes	946	5.7

The wounds formed the most important group; there were 3,763 such cases reported during 1916 or 22.8 per cent. of the total accidents and injuries. The burns followed with 2,948 cases or 17.9 per cent. Fractures were next in importance with 2,903 cases or 17.6 per cent. of the total; followed by sprains with 1,738 cases or 10.5 per cent. and contusions with 1,714 cases or 10.4 per cent.

Considering only the nursed cases with physician in attendance, we find in the group of "burns" cases that an average of 12.3 visits was made per case covering a period of 19.2 days with a visit made on an average of 1.6 days. Thirteen and seven tenths per cent. (13.7 per cent.) of the cases were transferred to institutions and a little less than 93 per cent. of the cases were discharged as either recovered or improved.

Similarly, contusions showed an average of 6.7 visits per case nursed with physician in attendance over a period of 12 nursing days per case. Dislocations nursed with physician in attendance required an average of 9.9 visits over a nursing period of 19.1 days. Fractures averaged 11.3 visits over a period of 24 nursing days. Sprains which were actively nursed showed an average of 6.9 visits over a period of 13.6 days. The wounds received 8.0 visits over a period of 13.1 days.

Nursing in life insurance health conservation work is especially useful in cases of accidents and injuries, not only because it prevents complications which so often arise, but because it is effective in shortening the period of disability for work.

From the foregoing detailed observation of a few of the diseases and conditions represented in our "acute" service classification, it will be seen that "acute" nursing as a group improved in the chief characteristics which distinguish this type of public health nursing: average visits per case; average days per case, and average time between visits.

II. CHRONIC DISEASES.

The main facts for the nursing of chronic conditions during the period 1914 to 1916 show that this type of nursing is being gradually reduced. Some of the individual diseases with chronic characteristics may now be examined.

Tuberculosis of the Lungs

This disease still forms a considerable proportion of the Company's nursed cases. The cases represented in our nursing experience of tuberculosis of the lungs fall into several groups:

(1) Incipient cases which require only instruction of the patient and of the family in personal hygiene, and where the nurse can urge sanatorium treatment. In many cases she arranges for the admission of the patient to a sanatorium.

(2) Moderately advanced cases which show promise of improvement from home treatment under proper medical observation and nursing care.

(3) Advanced and bedridden cases including those acutely sick, where transfer to institutional care would be either difficult or impossible.

The nursing experience with tuberculosis of the lungs is displayed in the following table.

TABLE XXI.

TUBERCULOSIS OF THE LUNGS NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	2,771	3,249	3,615
Per cent. of total nursed	2.0	2.6	3.2
Average visits per case	10.4	11.3	13.2
Average days per case	26.2	36.6	72.4
Time between visits (days)	2.5	3.2	5.5
Percentage recovered and improved	29.7	33.7	36.8
Percentage unimproved	38.5	34.9	29.1
Percentage dead	31.9	31.4	34.0
Percentage trans. to institutional care	36.5	31.9	30.4

With very nearly 500 cases less in 1916, and a substantial reduction in the amount, duration and intensity of service, the foregoing table presents quite a satisfactory showing. The rate of improvement in the several administrative elements of public health nursing service to tuberculosis seems to be slackening, however. In 1916 there was not such a decided improvement as that registered in the experience of 1915, considered on the basis of the 1914 record. It is possible that in the public health nursing of tuberculosis of the lungs there may be an "optimum" of (1) amount, (2) duration, (3) intensity of service. This point may now have been reached.

Cancer.

The amelioration of the condition of cancer patients, the promotion of their comfort and the easing of the burden of suffering allotted to these patients, is one of the important humanitarian services which public health nursing can render a group of the population at present but inadequately provided with proper medical and nursing facilities for cancer care. One valuable service, at least, which the public health nurse can often perform for the cancer patient is the transfer of the case to institutional care.

Cancer cases which come to the attention of the public health nurse may be considered under two heads: (1) those taken in the very earliest stages in which there is a reasonable certainty of cure through surgical procedure, and (2) those cases in which the prognosis is unfavorable and the work of the public health nurse is necessarily limited to acts of mercy which lessen the sufferings of the patient and otherwise promote his or her comfort. The Company's experience with cancer cases nursed with physician in attendance is shown in the following table:

TABLE XXII.

CANCER NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	1,617	1,635	1,510
Per cent. of total nursed	1.2	1.3	1.3
Average visits per case	14.4	13.4	16.8
Average days per case	27.1	27.0	38.0
Time between visits (days)	1.9	2.0	2.3
Percentage recovered and improved	22.1	25.5	26.0
Percentage unimproved	41.5	38.9	33.6
Percentage dead	36.4	35.6	40.4
Percentage trans. to institutional care	32.0	29.2	22.3

There was only a slight reduction in the proportion of cancer cases in the total experience of the nursing service. The average number of visits per case in 1916 (14.4) was lower than the figure recorded in 1914; the average number of days of nursing for cancer cases (27.1) was nearly ten days shorter in the later year than in 1914. A visit is made to the average cancer case about once every two days.

The percentage of cases discharged "unimproved" has increased from 33.6 in 1914 to 41.5 per cent. in 1916. This probably reflects the increase in the percentage of transfers to institutional care. In 1916, 32.0 per cent. of the cancer cases were referred to institutions as compared with 22.3 per cent. in 1914.

Rheumatism.

Our rheumatism experience shows a substantial improvement. In 1914, 3.5 per cent. of the nursing cases were of this disease, or rather, group of diseases. In 1916, 2.6 per cent. of the cases were reported as "rheumatism." We realize that this term covers a multitude of separate diseases and conditions which have symptoms simulating "rheumatism." There is no reason to believe, however, that reporting practice for "rheumatism" has changed in 1916 from the practice of

1914. Our figures, therefore, are comparable throughout. A reduction in the average number of visits per case was accomplished, the average period of nursing care and the time between visits were shortened. These facts are shown in the following table:

TABLE XXIII.

RHEUMATISM NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	3,572	3,362	3,927
Per cent. of total nursed	2.6	2.7	3.5
Average visits per case	9.9	9.5	10.8
Average days per case	18.9	19.5	25.5
Time between visits (days)	1.9	2.0	2.5
Percentage recovered and improved	84.6	84.4	85.4
Percentage unimproved	13.6	14.0	13.1
Percentage dead	1.8	1.7	1.5
Percentage trans. to institutional care	17.9	18.5	15.6

Organic Diseases of the Heart.

"Organic diseases of the heart" represent several heart conditions, all of which are practically chronic in nature. Nursing is quite an essential element in the proper care of a cardiac patient during the acute attacks. On the preventive side, nurses are often enabled to secure suitably light occupations for patients whom they have nursed through an acute attack. In fact, the function of education in hygiene for the heart patient is only beginning to be realized. Public health nursing, therefore, may be considered an important aid in the control of this disease which, in the industrial mortality experience of the Company, is a cause of more deaths than any other single disease, except tuberculosis. In the mortality experience of the general population, heart disease causes more deaths than any other disease or condition, not even excepting tuberculosis. The public health nurse has, therefore, an important field of usefulness in the active nursing care of acute attacks of heart disease and in the education of heart patients in the care of themselves during quiescent periods. We give on the next page a table of our nursing experience with organic diseases of the heart.

TABLE XXIV.

ORGANIC DISEASES OF THE HEART NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	1,855	1,741	1,552
Per cent. of total nursed	1.3	1.4	1.4
Average visits per case	10.3	10.0	11.2
Average days per case	20.5	21.8	28.0
Time between visits (days)	2.0	2.2	2.5
Percentage recovered and improved	52.8	49.9	53.2
Percentage unimproved	24.3	25.0	22.4
Percentage dead	22.9	25.1	24.4
Percentage trans. to institutional care	26.8	20.8	18.9

From these figures it will be seen that heart diseases constituted a smaller percentage of the total nursing cases and that the time between visits has been shortened. The percentage of cases transferred to institutional care has increased.

Diseases of the Veins.

This group of diseases comprise for the most part varicose veins together with a few cases of hemorrhoids.

The conditions which we have classified as diseases of the veins present a number of unusual nursing characteristics. Varices, especially when they result in chronic painful ulceration, present an unusual opportunity for the good offices of the nurse in aiding to restore the patient to working efficiency. There is no significant problem of mortality in connection with varicose conditions. The chief element of nursing interest in cases of venous engorgement, especially when ulcers develop, lies in reducing the period of pain and physical disability for work. The statistics for this disease show that there has been a small reduction of percentage of cases in our nursing experience with a reduction in the average number of visits per case, the average number of days per case and the shortening of the time between visits. We are probably getting more suitable types of cases for nursing endeavor in this disease. The higher percentage of cases discharged "unimproved" parallels the rise in the percentage of cases transferred to institutional care. This is an indication that the nurses are doing good work in releasing cases which require surgical procedure. The foregoing facts are shown in the following table.

TABLE XXV.

DISEASES OF THE VEINS NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	1,304	1,226	1,183
Per cent. of total nursed	.9	1.0	1.1
Average visits per case	10.9	11.0	12.3
Average days per case	23.0	31.6	30.4
Time between visits (days)	2.1	2.9	2.5
Percentage recovered and improved	82.5	82.7	84.7
Percentage unimproved	16.9	16.7	14.8
Percentage trans. to institutional care	27.6	27.4	22.3

Bright's Disease.

Bright's disease is also a condition running a chronic course, with occasional periods of acute exacerbation requiring skilled nursing attention. Insistence upon proper types of cases and of transfer to family care of those Bright's disease patients whose condition does not justify our keeping the case upon the books, has resulted in a reduction of the percentage of such cases in our nursing experience. The average number of visits per case, and the average number of days per case have been reduced. The time between visits in Bright's disease cases has been shortened decidedly, indicating that the nursing service as a whole has responded to our request for better choice in the placement of visits and in the proper discharge of cases. There has been a significant rise in the percentage of cases discharged to institutional care. Our nursing experience with Bright's disease is shown in the following table:

TABLE XXVI.

BRIGHT'S DISEASE NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	1,583	1,463	1,430
Per cent. of total nursed	1.1	1.2	1.3
Average visits per case	9.9	10.2	11.0
Average days per case	18.2	19.8	26.2
Time between visits (days)	1.8	2.0	2.4
Percentage recovered and improved	48.4	50.2	48.6
Percentage unimproved	23.3	22.9	23.9
Percentage dead	28.2	26.9	27.5
Percentage trans. to institutional care	22.1	23.0	19.1

III. MATERNITY NURSING.

The nursing of maternity conditions has from the beginning played an important part in the visiting nurse work of the Company. Thus, in 1916, out of 160,843 female policyholders visited, 41,572 or 25.8 per cent. were directly concerned with diseases and conditions of the puerperal state. Of this number of cases, 36,815 or 88.6 per cent. were for women between the ages of 20 and 40 years. There were accordingly in 1916, 19.5 maternity cases per 1,000 female industrial policyholders at these childbearing ages. The corresponding rate in 1915 was 17.6 per 1,000 and in 1914 only 15.8 per thousand. It will be seen, therefore, that the Company's wish to extend the work of its visiting nurse service to an increasingly larger number of women among its industrial policyholders is meeting with the support of the policyholders themselves, of the nurses, and of the agency staff.

Of the total number of puerperal cases in 1916, 32,907 were normal, *i. e.*, were concerned either with prenatal care alone, with prenatal care continuing through and including "after care," or with "after care" in childbirth only. In addition, there were 3,469 cases of abortion and miscarriage, 967 cases of puerperal septicemia, and a residual group of 4,229 cases including a number of other acute diseases and conditions of the puerperal state. There were in all 39,438 cases (95 per cent. of the total) which were under the care of a physician. Of this number, 30,189 were actually nursed, 7,070 were advised and 2,179 were neither nursed nor advised. The following table displays the chief characteristics of the entire visiting nurse service in maternity conditions during 1916:

TABLE XXVII.

NUMBER OF CASES OF SEVERAL TYPES OF MATERNITY CONDITIONS VISITED IN ENTIRE NURSING SERVICE IN 1916.

Disease or Condition	No. of Cases	Per Cent. of Total Female Cases	No. of Visits	Av. Visits per Case	Av. Nursing Days per Case
Total puerperal state	41,572	25.8	243,738	5.9	7.9
Abortions and miscarriages	3,469	2.2	19,511	5.6	7.5
Other accidents of pregnancy	483	.3	3,143	6.5	9.9
Pregnancy only	7,459	4.6	8,566	1.1	1.7
Pregnancy and after care only	1,552	1.0	12,582	8.1	25.6
After care only	23,896	14.9	151,502	6.3	7.5
Puerperal septicemia	967	.6	11,947	12.4	15.2
Puerperal albuminuria and convulsions	308	.2	3,101	10.1	15.1
Other diseases and conditions of puerperal state	3,438	2.1	33,386	9.7	13.0

The cases received an average of 5.9 visits covering a period of 7.9 days of nursing care. The number of visits and the number of nursing days vary, of course, with the type of puerperal case. Where there are complications of any kind, the nurse is expected to give service precisely as she would in any other case of acute disease. We find, therefore, an average of 12.4 visits running over a period of 15.2 days to cases of puerperal septicemia and an average of 10.1 visits running over a period of 15.1 days in cases of puerperal albuminuria and convulsions. The above figures differ only slightly from those covering the year 1915. They thus indicate that the standards established in that year have been maintained. A new feature of the service in 1916 worthy of note was the increase in the number of cases of prenatal service. There were 7,459 cases visited during pregnancy which represents an increase of 1,764 cases over the preceding year.

For purposes of detailed analysis, we shall limit our remarks to the "nursed cases with physician in attendance." There were 30,189 such cases in 1916 representing 21.9 per cent. of the total nursed service. The following table shows the experience with maternity cases nursed with physician in attendance over the three year period, from 1914 to 1916.

TABLE XXVIII.

MATERNITY SERVICE, 1916, 1915 AND 1914; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Class of Maternity Nursing	Number of Cases			Percentage of Total Nursed Cases		
	1916	1915	1914	1916	1915	1914
All maternity service	30,189	26,467	22,592	21.9	21.1	20.2
Accidents of pregnancy*	3,257	3,005	2,666	2.4	2.4	2.4
Abortions and miscarriages	2,870	2,643	†	2.1	2.1	†
Pregnancy only	292	371	†	.2	.3	†
Pregnancy and after care	1,424	1,027	15,870	1.0	.8	14.2
After care only	20,788	18,133	†	15.1	14.4	†
Puerperal septicemia	932	962	952	.7	.8	.9
Puerperal albuminuria and convulsions	271	269	258	.2	.2	.2
Other diseases of puerperal state	3,225	2,700	2,846	2.3	2.2	2.5

* Includes abortions and miscarriages.

† Not separately tabulated in 1914; included with "pregnancy and after care" in 1914.

The facts of the above table are encouraging. We find a continuous increase during the period in the proportion which the maternity cases formed of the total nursed cases. This is particularly true of the largest group, which has been designated "after care only." There is also a persistent decline in the proportion which the puerperal septicemia cases form of the total. This, we believe, reflects the careful work of the nurses in handling their cases both during pregnancy and after delivery. The infection of women in the course of accidents of pregnancy or during delivery or after delivery presents one of the most distressing conditions known to nursing experience. We shall now consider in some detail the nursing facts with reference to a number of the specific conditions observed in the foregoing table.

Accidents of Pregnancy.

In our experience with cases of this kind requiring actual nursing, the average number of visits remained stationary, the average number of days declined somewhat and the time between visits was shortened. These and other important facts are shown below:

TABLE XXIX.

ACCIDENTS OF PREGNANCY NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	3,257	3,005	2,666
Per cent. of total cases nursed	2.4	2.4	2.4
Average visits per case	6.7	6.7	6.7
Average days per case	9.1	9.5	10.6
Time between visits (days)	1.4	1.4	1.6
Percentage recovered and improved	92.9	92.7	92.4
Percentage unimproved	6.6	6.8	7.2
Percentage dead	.6	.5	.4
Percentage trans. to institutional care	10.0	11.1	10.1

After Care Only.

Our post-partum nursing experience in 1916 showed a stationary condition with respect to average number of visits, a slight increase in the average duration of nursing care, and no change in the frequency with which visits were made. The experience is shown in the following table.

TABLE XXX.

AFTER CARE IN CHILDBIRTH NURSING EXPERIENCE, 1916 AND 1915; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915
Number of cases	20,788	18,133
Per cent. of total nursed	15.1	14.4
Average visits per case	7.1	7.1
Average days per case	8.4	8.7
Time between visits (days)	1.2	1.2
Percentage recovered and improved	97.7	97.6
Percentage unimproved	2.3	2.3
Percentage trans. to institutional care	7.9	7.0

Until very recently the maternity work of the Company was limited practically to post-natal care. During 1916, the Service was considerably liberalized and more attention was paid to expectant mothers. Thus, in 1915 there were 5,695 cases of pregnancy only, with an average of 1.3 visits per case while in 1916 such cases comprised a total of 7,459 cases or 3.5 per cent. of the total service with 1.1 visits per case. In addition, there were in 1916, 1,552 cases of pregnancy carried through to after care in normal childbirth as compared with a figure of 1,147 in 1915.

Puerperal Septicemia.

The figures with respect to infection are presented in the following table:

TABLE XXXI.

PUERPERAL SEPTICEMIA NURSING EXPERIENCE, 1916, 1915 AND 1914; CASES WITH PHYSICIAN IN ATTENDANCE.

Item	1916	1915	1914
Number of cases	932	962	952
Per cent. of total nursed	.7	.8	.9
Average visits per case	12.8	13.0	12.4
Average days per case	15.7	15.9	17.2
Time between visits (days)	1.2	1.2	1.4
Percentage recovered and improved	84.0	84.2	81.9
Percentage unimproved	12.9	11.4	13.8
Percentage dead	3.1	4.4	4.3
Percentage trans. to institutional care	18.5	16.7	16.5

We have previously commented on the reduction in the number and proportion of puerperal septicemia cases. Along with this reduction in the frequency of the condition there was to be observed a somewhat fluctuating average number of visits per case, a shortening of the average period of nursing care and a practically stationary condition with respect to the frequency of visits (1 visit every 1.2 days). There was a much larger percentage of such cases transferred to institutional care, which perhaps accounts in some measure for the increase in the percentage of cases discharged unimproved in 1916 and for the decrease in the percentage of cases reported dead. Our experience with puerperal septicemia is indeed an encouraging indication of the increasing effectiveness of public health nursing in maternity conditions.

During 1911, there were 70.1 deaths from causes associated with childbirth per 100,000 white female policyholders between the ages of 15 and 44. In 1916 the death rate from these conditions was reduced to 62.6 per 100,000, a decrease in the rate of 10.7 per cent. Among colored female policyholders the rate for mortality from causes connected with childbearing was 88.4 per 100,000 in 1911. This rate was reduced to a figure of 70.4 in 1916, a decline of 20.4 per cent. The consistent decline in mortality from puerperal conditions and diseases among both white and colored policyholders is in marked contrast to the mortality figures for the general population included in the Registration Area for deaths in the United States. In the five years prior to 1916, the death rate from the diseases connected with childbearing had been practically stationary. There is in these comparisons, therefore, a strong endorsement of the Company's programme of extending its facilities for public health nursing to parturient women.

NURSING RESULTS IN PRINCIPAL ASSOCIATIONS.

The foregoing observations have been based upon the nursing results of the entire service. Our figures have included the associations in the larger cities as well as the many individual services located in the smaller communities. It is generally agreed that the larger associations in the urban centres have developed much more efficient organizations, that their work is more subject to administrative control and has been much more standardized than is possible for the many smaller organizations with their more limited facilities.

It has seemed desirable, therefore, to prepare statistics covering the main points of the service as conducted by a group of the principal nursing associations of the country. We have chosen twelve for this purpose located in the following cities:

Baltimore
Boston
Brooklyn
Buffalo
Chicago
Cincinnati
Cleveland
Manhattan and Bronx Boroughs, N. Y. City
Philadelphia
Providence
St. Louis
Washington, D. C.

These associations are well known; many of them are of long standing and all of them are under competent management. The fundamental principles of visiting nursing are recognized by all of them. The results which are shown in the following table may, in many cases, serve as standards for the other and smaller societies. The following table presents a comparison of the several classes of service for the twelve principal associations contrasted with the corresponding figures for the entire Visiting Nurse service:

TABLE XXXII.

PERCENTAGE OF CASES IN SPECIFIED CLASS OF NURSING SERVICE, ENTIRE VISITING NURSE SERVICE AND TWELVE PRINCIPAL ASSOCIATIONS COMPARED, 1916.

Class of Service	Percentage of Total	
	Entire Service	Twelve Associations
All classes	100.0	100.0
With physician in attendance	87.2	88.5
Nursed	64.3	60.7
Advised	15.3	18.8
Not nursed	7.6	9.0
Without physician in attendance	12.8	11.5

It is, of course, evident that while there are indisputable bases for the operation of all visiting nurse societies in large cities, there must be a reasonably elastic administrative programme to meet local conditions. Thus, the twelve principal associations had a higher percentage of cases with physician in attendance, 88.5 per cent. as compared with 87.2 per cent. in the entire service. The proportion of nursed cases under medical observation was less, however, than that recorded for the entire service. This reflects a higher ratio of advisory service, and suggests that the large city services have different programmes which provide for a greater amount of advisory service, for instance, in prenatal work. This latter branch of public health nursing activity is not so well developed in the many smaller services which this Company conducts as among the group of principal associations noted above. We find, furthermore, a higher percentage of "not nursed" cases in the twelve associations and this, as we shall see later, may be the result of the effort which these associations make to transfer certain types of cases to other treatment, especially hospitals and sanatoria whose facilities are more available in larger cities.

The experience shown for a public health nursing society is in a very large measure determined by such important local factors as the extent of hospital facilities in a given community, the degree to which physicians coöperate with the association, the attitude of the population served toward the work of the association, the density of the population, the character of the housing of the population, the nature of the industries which provide a means of livelihood for the community reached, and the funding conditions for philanthropic work in the local area.

EXPERIENCE OF ENTIRE SERVICE AND GROUP OF TWELVE ASSOCIATIONS COMPARED, 1916.

It will be of some interest in this connection to view comparatively the experience of the entire Visiting Nurse Service and the group of twelve principal associations with the several diseases and conditions nursed and advised with physician in attendance. There was a much greater percentage of typhoid fever in the entire service (2.3) than in the experience of the twelve city associations combined (1.0). This perhaps reflects the care which large cities have taken in recent years to safeguard their water and milk supplies. The nursing of the communicable diseases of childhood showed a slightly greater proportion among the group of twelve principal associations than in the entire service. It will be recalled that the large associations in many instances have special facilities for the care of communicable diseases of children. This is reflected in the combined experience shown for this group of twelve public health nursing societies.

The influenza ratio was lower for the group of twelve associations than for the entire service, indicating perhaps that the epidemic of this disease did not affect the group of cities studied as much as it did the smaller associations which made up a large part of the experience of the entire service. Among the nursed and advised cases in total, tuberculosis of the lungs constituted about the same percentage in both experiences. The twelve associations show a much higher ratio of cases of the puerperal state, especially advisory cases of pregnancy and cases of after care in childbirth. Accidents and injuries as a class showed a slightly lower percentage for the twelve principal associations than for the entire service. This fact is perhaps accounted for by the more plentiful hospital and dispensary facilities in large cities. The foregoing facts and other relations between the entire service and the twelve principal associations are shown in Table XXXIII.

TYPES OF CASES IN SIX PRINCIPAL ASSOCIATIONS COMPARED.

While 88.5 per cent. of the total cases in the group of twelve associations showed a physician in attendance, only 82.2 per cent. were thus recorded in the Brooklyn service and 91.0 per cent. in the Boston service. Nursed cases with physician in attendance were recorded in 60.7 per cent. of the total service of the twelve principal associations. The Baltimore service showed only 43.4 per cent. nursed and the Boston association 76.8 per cent nursed with physician in attendance. Advisory service seemed to be represented in nearly one third of the total cases of the Philadelphia service and in only a slightly smaller proportion (31.6 per cent.) of the Baltimore service. The group of twelve principal associations showed 18.8 per cent. of the cases to have been advised with physician in attendance. Cases not nursed with physician in attendance were recorded in 9.0 per cent. of the service for the group of

TABLE XXXIII.

NUMBER OF CASES AND PERCENTAGE OF TOTAL; PRINCIPAL DISEASES AND CONDITIONS IN NURSED AND ADVISED SERVICE COMBINED; CASES WITH PHYSICIAN IN ATTENDANCE; ENTIRE VISITING NURSE SERVICE AND GROUP OF TWELVE PRINCIPAL ASSOCIATIONS COMPARED, 1916.

Disease or Condition	Entire Service		Twelve Principal Associations	
	No. of Cases	Per Cent. of Total	No. of Cases	Per Cent. of Total
All diseases and conditions	170,633	100.0	38,861	100.0
General diseases	42,548	24.9	8,020	20.6
Typhoid fever	3,929	2.3	387	1.0
Measles	3,902	2.3	927	2.4
Scarlet fever	708	.4	343	.9
Whooping cough	1,188	.7	224	.6
Diphtheria and croup	945	.6	367	.9
Influenza	12,735	7.5	1,982	5.1
Tuberculosis of the lungs	3,738	2.2	798	2.1
Other forms of tuberculosis	1,020	.6	200	.5
Cancer and other malignant tumors	1,793	1.1	489	1.3
Rheumatism	4,257	2.5	1,086	2.8
Other general diseases	8,333	4.9	1,217	3.1
Diseases of nervous system and organs of special sense	8,239	4.8	2,107	5.4
Cerebral hemorrhage, apoplexy, paralysis	2,148	1.3	639	1.6
Diseases of the eyes and ears	2,288	1.3	519	1.3
Other diseases of the nervous system	3,803	2.2	949	2.4
Diseases of the circulatory system	5,428	3.2	1,538	4.0
Organic diseases of the heart	2,180	1.3	549	1.4
Diseases of the veins	1,494	.9	522	1.3
Other diseases of the circulatory system	1,754	1.0	467	1.2
Diseases of the respiratory system	21,570	12.6	5,410	13.9
"Colds," coryza and rhinitis	1,929	1.1	373	1.0
Bronchitis	5,591	3.3	1,520	3.9
Bronchopneumonia	2,316	1.4	756	1.9
Pneumonia (lobar and undefined)	8,743	5.1	2,113	5.4
Other diseases of the respiratory system	2,991	1.8	648	1.7
Diseases of the digestive system	22,487	13.2	4,341	11.2
Tonsillitis	6,334	3.7	1,320	3.4
Diseases of the stomach	4,049	2.4	731	1.9
Diarrhea and enteritis	4,772	2.8	877	2.3
Other diseases of digestive system	7,332	4.3	1,413	3.6
Non-venereal diseases of the genito-urinary system	10,216	6.0	1,965	5.1
The puerperal state	37,259	21.8	10,492	27.0
Pregnancy only	5,739	3.4	2,578	6.6
Pregnancy and after care	1,521	.9	674	1.7
After care only	21,842	12.8	5,269	13.6
Other diseases and conditions of the puerperal state	8,157	4.8	1,971	5.1
Diseases of the skin	3,937	2.3	771	2.0
External causes	12,793	7.5	2,698	6.9
Burns	2,330	1.4	562	1.4
Contusions	1,277	.7	339	.9
Dislocations	202	.1	34	.1
Fractures	2,430	1.4	585	1.5
Sprains	1,272	.7	294	.8
Wounds	2,866	1.7	422	1.1
All other and unclassified injuries	1,643	1.0	327	.8
All other external causes	773	.5	135	.3
All other diseases and conditions	6,156	3.6	1,519	3.9

twelve associations, in 14.9 per cent. of the cases for Henry Street, 14.1 per cent. of the cases in the Brooklyn service and 9.9 per cent. in the Baltimore service. The Boston association Metropolitan cases showed only 1.4 per cent. to have been "not nursed with physician in attendance." The fact stands out that at present there is no uniformity in the main results of the leading services of the United States. The degree of development of the public health nursing programme differs in each of the cities. No permanent conclusions should be drawn from these comparative statements, therefore, until the influence of strictly local circumstances is discounted. The following table exhibits the main facts for the types of cases represented in the leading services:

TABLE XXXIV.

NUMBER OF CASES AND PERCENTAGE OF SEVERAL TYPES OF CASES IN EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS AND OF SIX LEADING PUBLIC HEALTH NURSING ASSOCIATIONS, 1916.

Association	Total No. of Cases, All Classes of Service	Percentage with Physician in Attendance				% Without Physician in Attendance
		All Classes	Nursed	Advised	Not Nursed	
Twelve principal ass'ns	48,861	88.5	60.7	18.8	9.0	11.5
Henry St. Settlement	9,981	87.2	60.6	11.6	14.9	12.8
Brooklyn D. N. Comm.	4,893	82.2	46.4	21.6	14.1	17.8
V. N. Ass'n of Chicago	6,877	85.0	71.6	8.9	4.6	15.0
V. N. Soc. of Philadelphia	5,860	90.6	53.6	32.8	4.2	9.4
Inst. V. N. Ass'n of Baltimore	2,219	84.9	43.4	31.6	9.9	15.1
Inst. Dist. Nursing Ass'n of Boston	4,701	91.0	76.8	12.7	1.4	9.0

Let us now view the experience of the chief services with respect to the important diseases and conditions.

EXPERIENCE OF INDIVIDUAL ASSOCIATIONS FOR CERTAIN DISEASES AND CONDITIONS.

Four Communicable Diseases of Children.

The nursing experience of the group of twelve principal associations and of each of the six leading societies in this group, was compiled to bring out the chief characteristics of the nursing work in connection with a number of important diseases and conditions. The first of these groups of diseases was the four communicable diseases of children, namely, measles, scarlet fever, whooping cough and diphtheria. For the twelve principal associations there was a decrease in the percentage of this group of diseases of children from 5.1 in 1914 to 4.5 in 1916. A comparison of the experience of each of the six associations is shown in the following table:

TABLE XXXV.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH FOUR COMMUNICABLE DISEASES OF CHILDREN, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional care
						Recovered	Improved	Dead	
Twelve principal ass'ns	1,347	4.5	6.9	14.5	2.1	66.7	20.1	3.3	15.5
Henry St. Settlement	587	9.7	8.2	13.2	1.6	83.2	6.7	3.9	9.9
Brooklyn D. N. Comm.	140	6.2	5.9	13.4	2.3	47.9	45.0	2.9	19.4
V. N. Ass'n of Chicago	360	7.3	6.0	19.5	3.2	55.2	31.2	3.6	22.0
V. N. Soc. of Philadelphia	11	.4	8.2	16.4	2.0	18.2	54.5	...	9.1
Inst. V. N. Ass'n of Baltimore	4	.4	3.5	8.0	2.3	....	33.3	...	100.0
Inst. D. N. Ass'n of Boston	171	4.7	5.3	11.6	2.2	76.6	11.7	1.2	12.9

The individual services show a varying percentage of these diseases in the total nursing experience. Thus, while the twelve principal associations showed 4.5 per cent., Henry Street Settlement showed 9.7 per cent., the maximum for this series, the societies in Philadelphia and Baltimore showed four tenths of 1 per cent., the minimum for this series. The active nursing of these diseases in the work of a general public health nursing society or association is dependent in many instances upon the facilities of a particular association for carrying on this work in such a manner that cross-infection will not be incurred. The Henry Street Settlement has apparently worked out a definite and satisfactory program for the care of these diseases.

The remaining statistics for this group of diseases show no particular tendency toward uniformity.

Tuberculosis of the Lungs.

The public health nursing associations were perhaps the first to demonstrate the possibilities for public health nursing of tuberculosis and for education of families in the prevention of further infection. Tuberculosis of the lungs constituted only 2.0 per cent. of the total cases nursed in the group of twelve principal associations. The Henry Street Settlement showed the same percentage as the group of twelve services. In Boston there was found the least percentage of tuberculosis (1.0) and in Philadelphia, the highest (3.9). The average number of visits per case tended to fluctuate considerably above the figure of 9.1 for the group of twelve services taken together. Thus, though the Chicago service gave only 4.0 visits per case (the minimum) with a very high percentage of cases transferred to institutional care, the Philadelphia service showed an average of 12.8 visits with a low figure of transferred to institutional care (40.0 per cent.). The available facilities for institutional care, and the readiness with which the nursing associations take advantage of such existing facilities, evidently have profound influence upon the figures of tuberculosis public health nursing. It must be remembered that the types of cases admitted to service have much to do with the results exhibited. Thus, an association which has opportunity to reach incipient cases is likely to show a high percentage of transfers where sanitorium facilities for such cases are available. If the cases come to an association as bedridden and *in extremis*, the association is not likely to report a high percentage of institutional transfers but perhaps, a fairly high average number of visits with a short period between visits. It has not been possible to separate the cases

TABLE XXXVI.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH TUBERCULOSIS OF THE LUNGS, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns ...	593	2.0	9.1	21.9	2.4	.3	16.5	29.4	54.1
Henry St. Settlement.....	121	2.0	8.9	14.1	1.6	....	17.4	24.0	62.8
Brooklyn D. N. Comm....	39	1.7	11.5	23.9	2.1	....	15.4	35.9	59.0
V. N. Ass'n of Chicago ...	77	1.6	4.0	8.6	2.1	....	3.9	11.7	87.0
V. N. Soc. of Philadelphia.	122	3.9	12.8	40.1	3.1	....	11.7	55.0	40.0
Inst. V. N. Ass'n of Baltimore..................	23	2.4	4.4	8.3	1.9	....	9.5	9.5	87.0
Inst. D. N. Ass'n of Boston..................	35	1.0	9.0	19.0	2.1	2.9	28.6	28.6	40.0

in our statistics according to stage of disease nursed. If such a classification were possible, additional facts of some importance would have been available for quotation in this report. The accompanying Table XXXVI gives the tuberculosis of the lungs experience for the year 1916.

Rheumatism.

There is a tendency for cases of this type to center about 3 per cent. as the ratio in the total nursed cases. The average number of visits per case, however, varies considerably, dependent principally upon the number of cases transferred to institutional care and upon the acute or chronic character of the cases nursed. There was an average of 10.2 visits per case for the twelve associations. The Baltimore association showed the least average number, 4.6, and the Chicago association the greatest average number of visits, 11.6 per case. The average number of nursing days varied considerably from the average of 21.7 for the twelve associations combined. The Baltimore association showed the lowest figure, 10.4 days per case, and the Chicago association the highest, 29.7 days. The average number of days per visit, our index of the time between visits, varied also. There was a visit once every 2.1 days for the group of twelve associations. Henry Street showed the least interval between visits, 1.7 days, and Philadelphia the greatest interval, 3.0

TABLE XXXVII.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED, AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH RHEUMATISM, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns ...	879	3.0	10.2	21.7	2.1	26.4	56.3	1.8	28.4
Henry St. Settlement.....	176	2.9	11.5	19.3	1.7	44.0	37.7	1.1	38.6
Brooklyn D. N. Comm....	77	3.4	9.2	20.3	2.2	16.9	70.1	1.3	37.7
V. N. Ass'n of Chicago ...	120	2.4	11.6	29.7	2.6	10.8	69.2	5.0	30.0
V. N. Soc. of Philadelphia.	91	2.9	9.8	29.1	3.0	23.1	58.2	1.1	21.1
Inst. V. N. Ass'n of Baltimore................	38	3.9	4.6	10.4	2.3	....	72.2	2.8	73.7
Inst. D. N. Ass'n of Boston..................	123	3.4	11.2	23.8	2.1	48.0	33.3	.8	27.6

days. The Baltimore association showed the highest percentage of rheumatism cases discharged to institutions, 73.7 per cent., and the Philadelphia association the least percentage, 21.1. Table XXXVII gives the main facts of our rheumatism service.

Bronchitis.

The nursing service to bronchitis shows quite some variation in its percentage of total nursed cases. For the twelve principal associations combined, 3.9 per cent. were bronchitis. The Baltimore association showed the least percentage, 1.1, and the Boston association the highest, 5.2. There were for the twelve associations combined 6.4 visits per case. The Henry Street Settlement showed the highest average visits, 7.9, and the Baltimore association the least, 3.4 per case. The Chicago association showed the longest duration of nursing for bronchitis, 15.3 days per case, and the Baltimore association the least, 5.9 days per case. A visit was made every two days for the bronchitis cases in the group of twelve principal associations. Henry Street Settlement showed the least interval between visits and the Chicago service the greatest. The Baltimore service discharged the highest percentage of bronchitis cases to institutions (many to its own list) and Henry Street Settlement the least. The foregoing facts are shown in the following table:

TABLE XXXVIII.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH BRONCHITIS, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns . . .	1,161	3.9	6.4	12.8	2.0	52.2	39.4	2.7	12.1
Henry St. Settlement.	277	4.6	7.9	10.9	1.4	83.4	10.8	2.2	8.3
Brooklyn D. N. Comm. . . .	93	4.1	6.3	12.4	2.0	46.2	47.3	. . .	19.4
V. N. Ass'n of Chicago . . .	250	5.1	5.2	15.3	3.0	32.4	60.4	1.6	20.9
V. N. Soc. of Philadelphia.	117	3.7	6.1	13.4	2.2	39.7	47.4	5.2	8.5
Inst. V. N. Ass'n of Baltimore.	11	1.1	3.4	5.9	1.8	. . . .	81.8	9.1	81.8
Inst. D. N. Ass'n of Boston.	186	5.2	6.4	14.8	2.3	67.0	23.2	2.7	8.6

Pneumonia.

The nursing experience for pneumonia in the year 1916 is of exceedingly great interest. The Henry Street Settlement again showed the highest percentage of cases of this disease in the total nursing experience. The twelve associations combined registered 8.8 per cent. for pneumonia, the Henry Street figure was 15.3 per cent. and Chicago, which showed the least percentage, had a figure of 6.4. Henry Street showed the highest average visits per case, 12.9, and the greatest frequency of visits, namely, 1 visit every day. This is coupled with the highest percentage of recoveries. The Brooklyn service showed an average of 8.2 visits, 1 visit every 1.6 days. The Philadelphia service, which showed an average of 8.8 visits per case, also visited pneumonia cases once every 1.6 days. The facts shown in the following table bear out the Company's attitude toward increasing the frequency of visits during the critical stage of illness, in order to shorten the nursing period and to increase the percentage of recovered and improved cases.

TABLE XXXIX.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH PNEUMONIA—ALL FORMS, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns	2,624	8.8	10.0	13.3	1.3	54.9	25.6	8.9	13.7
Henry St. Settlement	925	15.3	12.9	13.5	1.0	79.2	3.3	7.0	12.1
Brooklyn D. N. Comm.	235	10.3	8.2	13.1	1.6	55.7	31.1	7.2	15.7
V. N. Ass'n of Chicago	316	6.4	8.5	16.0	1.9	44.6	34.5	8.2	17.1
V. N. Soc. of Philadelphia	263	8.4	8.8	13.9	1.6	45.2	31.2	14.4	9.5
Inst. V. N. Ass'n of Baltimore	95	9.9	6.5	10.5	1.6	19.1	53.2	13.8	45.3
Inst. D. N. Ass'n of Boston	238	6.6	8.1	12.4	1.5	63.9	10.5	8.8	16.8

After Care in Childbirth.

The group of twelve principal associations showed a percentage of these cases, 17.1, which was higher than that for the nursing experience of the entire Visiting Nurse Service, 15.1. The Baltimore service showed the least percentage of after care cases in the nursing experience, 2.4, and the Philadelphia service the maximum percentage, 30.8. The average number of visits per case for the twelve associations was 7.9 per cent.; Henry Street Settlement showed a figure of 6.4 visits, the Baltimore service 5.6 and the Chicago service, 6.9 visits. The twelve associations combined showed an average of 10.1 days with a visit once every 1.3 days. The same frequency was observed for Henry Street, Brooklyn and Chicago. The Philadelphia service showed a visit once every 1.4 days, whereas in Baltimore and Boston visits were made with lesser intervals than for the average of the twelve associations. Baltimore is clearly not concerned with the care of normal maternity, the cases being transferred to other agencies. The facts for after care in childbirth are displayed in the following table:

TABLE XL.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH AFTER CARE IN CHILDBIRTH, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns...	5,084	17.1	7.9	10.1	1.3	68.0	29.1	...	9.6
Henry St. Settlement.....	633	10.5	6.4	8.1	1.3	82.4	15.1	.2	11.7
Brooklyn D. N. Comm....	318	14.0	7.3	9.2	1.3	82.4	15.7	...	15.4
V. N. Ass'n of Chicago...	612	12.4	6.9	9.1	1.3	53.2	40.7	...	29.9
V. N. Soc. of Philadelphia.	966	30.8	7.6	10.3	1.4	84.8	14.6	...	4.1
Inst. V. N. Ass'n of Baltimore..................	23	2.4	5.6	6.3	1.1	8.7	87.0	...	39.1
Inst. D. N. Ass'n of Boston..................	592	16.4	7.1	8.7	1.2	95.6	2.9	.2	3.6

Abnormal Conditions of the Puerperal State.

The nursing of these conditions, as was pointed out in a previous section of this report, provides an exceptional opportunity for the service of the public health nurse. The twelve principal associations showed 6.2 per cent. of the total cases to have been abnormal conditions of the puerperal state, such as septicemia, albuminuria, accidents of pregnancy and accidents of labor. The Philadelphia service showed the highest percentage of abnormal conditions of the puerperal state, 7.2, and the Brooklyn service the least, 3.1. The twelve associations combined gave an average of 9.5 visits per case for a period of 14.1 days or 1 visit every 1.5 days. The Chicago service showed the highest average period of nursing care, 20.2 days, but also the greatest interval between visits, 2.1 days. With the exception of the Baltimore service, where a number of transfers to the general list of that association disturbed the percentage for institutional care, the Brooklyn service showed the highest percentage of such discharges in cases of abnormal puerperal conditions. The available facts on the nursing experience of abnormal conditions of the puerperal state are shown in the following table:

TABLE XLI.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED, AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH ABNORMAL CONDITIONS OF THE PUERPERAL STATE, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns . . .	1,843	6.2	9.5	14.1	1.5	56.3	36.0	.8	12.2
Henry St. Settlement	337	5.6	9.1	11.8	1.3	73.1	17.3	. . .	17.3
Brooklyn D. N. Comm. . . .	71	3.1	9.8	14.0	1.4	50.7	38.0	. . .	29.6
V. N. Ass'n of Chicago . . .	185	3.8	9.5	20.2	2.1	50.3	40.4	1.1	16.8
V. N. Soc. of Philadelphia .	226	7.2	9.7	14.5	1.5	72.9	20.4	.9	8.9
Inst. V. N. Ass'n of Baltimore	35	3.6	6.3	9.5	1.5	11.4	60.0	8.6	45.7
Inst. D. N. Ass'n of Boston	211	5.8	10.6	17.8	1.7	75.2	17.6	1.0	8.1

Accidents and Injuries.

The Baltimore service for several years has registered the highest percentage of cases of accidents and injuries. In 1916, 11.0 per cent. of the cases were so reported. The average for the twelve associations combined was 7.3 per cent. The Philadelphia service showed the least percentage of accidents and injuries, 5.6 per cent. The twelve principal associations registered an average of 9.6 visits per case. The figure was higher for the Chicago and Boston services (10.5 visits per case in each city) and also for the Philadelphia service, 9.9 visits per case. The Baltimore service showed the least average, 5.7 visits per case.

An average of 19.9 days of nursing was accorded by the twelve associations combined. In Philadelphia the figure was 27.4 and in Baltimore 13.0 days per case. The figures displayed for Baltimore must be considered in the light of the transfers of accident cases from the Metropolitan list to the general list of the association. In accident cases a visit was made once every 2.1 days for the group of twelve associations. The greatest time between visits was displayed by the Philadelphia service, 1 visit every 2.8 days, and the least interval by the Henry Street Settlement, 1 visit every 1.9 days. The accident experience of the leading services is shown in the following table:

TABLE XLII.

NURSING EXPERIENCE OF TWELVE PRINCIPAL ASSOCIATIONS COMBINED AND OF SIX PRINCIPAL ASSOCIATIONS SINGLY, WITH ACCIDENTS AND INJURIES, 1916; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Association	No. of Cases	Per Cent. of Total, All Diseases	Av. Visits per Case	Av. Days per Case	Av. Days per Visit	Percentage			% To Institutional Care
						Recovered	Improved	Dead	
Twelve principal ass'ns . . .	2,157	7.8	9.6	19.9	2.1	37.9	51.2	1.8	26.0
Henry St. Settlement.	365	6.0	9.1	17.2	1.9	44.2	42.0	1.6	42.9
Brooklyn D. N. Comm. . . .	192	8.5	8.8	18.2	2.0	38.0	47.4	2.6	37.0
V. N. Ass'n of Chicago . . .	404	8.2	10.5	24.3	2.3	41.3	50.0	1.0	25.6
V. N. Soc. of Philadelphia.	175	5.6	9.9	27.4	2.8	28.6	58.3	4.0	17.8
Inst. V. N. Ass'n of Baltimore.	106	11.0	5.7	13.0	2.3	11.9	76.2	2.0	61.5
Inst. D. N. Ass'n of Boston.	274	7.6	10.5	21.5	2.1	58.2	32.6	1.5	17.2

COST OF THE SERVICE.

Table I showed the statistics of total cost of the Visiting Nurse Service in each of the fiscal years since its inception. During the calendar year 1916, 217,422 cases were closed by the service and these cost, in total, $613,030.25. The average case nursed with physician in attendance cost $4.12 during the calendar year 1916. For some diseases this cost per case was higher than for others. Thus, typhoid fever showed an average cost per case of $7.21 and puerperal septicemia an average cost per case of $6.59. Colds, coryza and rhinitis on the other hand showed a low average cost of $1.49 and cases of tonsillitis, an average of $2.11.

TABLE XLIII.

COMPARISON OF RESULTS IN CONTROL OF COST OF NURSES' VISITS. PRINCIPAL DISEASES AND CONDITIONS, ENTIRE VISITING NURSE SERVICE OF 1916, 1915 AND 1914; CASES NURSED WITH PHYSICIAN IN ATTENDANCE.

Disease or Condition	Average Cost per Case		
	1916	1915	1914
All diseases and conditions	$4.12	$4.10	$4.22
Typhoid fever	7.21	6.98	6.56
Malaria	2.83	2.77	2.73
Measles	2.73	2.92	2.83
Influenza	2.83	2.62	2.73
Tuberculosis of lungs	5.36	5.80	6.56
Cancer, all forms	7.42	6.87	8.35
Cerebral hemorrhage, apoplexy and paralysis	5.51	5.54	6.41
Organic diseases of the heart	5.30	5.13	5.57
Diseases of the veins	5.61	5.64	6.11
Colds, coryza and rhinitis	1.49	1.59	1.54
Bronchitis	3.04	2.92	3.03
Bronchopneumonia	4.38	4.36	4.32
Pneumonia-lobar and undefined	4.69	4.57	4.22
Tonsillitis	2.11	2.10	2.09
Diarrhea and enteritis	3.30	3.23	3.33
Appendicitis	4.33	4.16	3.93
Bright's disease	5.10	5.23	5.47
Salpingitis and other diseases of female genital organs	4.22	3.95	4.13
The puerperal state (total)	3.97	3.95	3.83
Accidents of pregnancy	3.45	4.21	3.33
Pregnancy only	2.06	2.67	2.44
Pregnancy and after care in normal childbirth	3.71	4.36	3.53
Puerperal septicemia	6.59	6.67	6.16
Puerperal albuminuria and convulsions	5.82	5.75	5.42
Other diseases and conditions of puerperal state	5.30	5.28	5.17
External causes (total)	4.69	4.62	4.52
Burns	6.33	6.00	5.77

In general there was but slight change in the cost figures of the acute diseases and conditions for which visiting nurse standards already exist. Typhoid fever, however, cost an average of $7.21 in 1916 as compared with $6.56 in 1914, and pneumonia increased in average cost from $4.22 in 1914 to $4.69 per case in 1916. The most striking decreases in the average cost per case were achieved for the chronic diseases and conditions. Tuberculosis of the lungs declined in average cost per case from $6.56 in 1914 to $5.36 in 1916; cancer cases cost an average of $8.35 in 1914 as compared with $7.42 in 1916. Similarly favorable reductions were accomplished for cerebral hemorrhage, apoplexy and paralysis cases, cases of organic diseases of the heart, diseases of the veins, and Bright's disease.

EFFECT OF THE VISITING NURSE SERVICE UPON THE MORTALITY EXPERIENCE OF POLICYHOLDERS.

Until recently no statistics have been available to determine, even approximately, the effect which the Visiting Nurse Service of the Company may have had on the mortality experience of the policyholders in the Industrial Department. It is now possible to offer a table showing the comparative reductions in the mortality from all causes and from certain of the principal causes of death among policyholders of the Company, and in the general population of the Registration Area of the United States. We shall limit this comparison to the five year period between 1911 and 1915. Figures for 1916 are available for the policyholders of the Company but not for the general population, for which 1915 is the last year of record. The following table presents this comparison:

TABLE XLIV.

COMPARISON OF DEATH RATES PER 100,000 LIVING; PRINCIPAL DISEASES AND CONDITIONS; METROPOLITAN LIFE INSURANCE COMPANY, INDUSTRIAL DEPARTMENT AND REGISTRATION AREA OF THE UNITED STATES, 1911-1915.

Diseases and Conditions	Metropolitan Life‡		United States Registration Area‡		Percentage, 1915 of 1911 Rate	
	1915	1911	1915	1911		
	Rate per 100,000	Rate per 100,000	Rate per 100,000	Rate per 100,000	Met.	U. S. Reg A.
All diseases and conditions....	1130.9	1253.0	1350.2	1415.9	90.3	95.1
Typhoid fever............	12.9	22.8	12.4	21.0	56.6	59.0
Measles, scarlet fever, whooping cough, diphtheria.....	36.6	58.9	32.7	49.0	62.1	66.7
Tuberculosis (all forms).....	197.8	224.6	145.8	158.9	88.1	91.8
Tuberculosis of lungs........	180.0	203.0	127.7	138.0	88.7	92.5
Acute and chronic bronchitis.	11.5	15.2	17.3	19.5	75.7	88.7
Pneumonia (all forms)*	106.5	115.2	132.7	133.7	92.4	99.3
Diarrhea and enteritis	24.4	27.9	24.3†	28.3†	87.5	85.9†
Cirrhosis of liver..........	14.0	16.3	12.5	14.0	85.9	89.3
Puerperal diseases and conditions (females, ages 15–44 yrs.)§..................	65.3	72.9	61.6	64.5	89.6	95.5
External causes...........	88.2	97.9	99.9	107.4	90.1	93.0

* Includes broncho- and lobar pneumonia.

† Diarrhea and enteritis deaths and estimated population under one year of age excluded in computing this rate.

‡ Metropolitan exposure and deaths contain no persons under one year of age; Registration Area rates are on basis of estimated population and deaths at all ages. See notes † and §.

§ Mortality rate from puerperal diseases, in both Metropolitan and Registration Area experiences, computed upon basis of total female estimated exposure, 15 to 44 yrs., and deaths of females, 15 to 44 yrs.

The mortality experience of the Company has constantly improved during this period, showing a decline of 9.7 per cent. in the mortality from all causes. In the same period of five years the decline in the death rate in the population of the Registration Area was only 4.9 per cent. The improvement was, therefore, almost twice as great among the policyholders of the Company as in the general population. The importance of these reductions in the insurance experience is indicated by the fact that had the 1911 rate continued into 1915 the number of deaths that would have occurred would have been 11,800 more than were actually registered. This number is so large that it gives much encouragement to continue the various activities in which the Company has been engaged for the conservation of human life.

The reduction in the rate of mortality is much more marked for certain causes of death than for others. Typhoid fever, for instance, had a rate of 22.8 per hundred thousand in 1911 and only 12.9 in 1915. The latter rate represents a reduction of 43 per cent. in the five year period. The corresponding reduction in the Registration Area was 41 per cent. For the group of the four infectious diseases of children, namely, measles, scarlet fever, whooping cough and diphtheria, there was a reduction of 38 per cent. among the policyholders and of 33 per cent. in the general population. The improvement in the tuberculosis death rate is very encouraging. For all forms of tuberculosis, the 1915 rate was 12 per cent. under that for 1911, although the reduction in the Registration Area was only a little over 8 per cent.

Pneumonia (all forms) on a similar basis shows a reduction of 7.6 per cent among the policyholders and of less than 1 per cent. in the general population. The puerperal diseases and conditions show a reduction of 10.4 per cent. in the policyholder death rates of the five year period as against no reduction whatever in the Registration Area. For this important group of conditions we have necessarily limited our comparison to females in the age period 15 to 44. Finally, the reduction in the rate for the group of accidents and injuries was 9.9 per cent. among the insured and only 7.0 per cent. in the population.

It will be observed that the improvement found in the Metropolitan experience is uniformly greater than that in the population at large. Furthermore, the greatest reductions appear in those conditions which are most prominently represented in the records of the Visiting Nurse Service. The Service has from the very beginning placed the greatest stress on the acute diseases and conditions such as typhoid fever, pneumonia, the puerperal diseases and the accidents and injuries (external causes), and has given only secondary consideration to the chronic conditions like cancer and heart disease. This administrative policy is apparently reflected in the mortality returns; the best reductions appear where the greatest nursing effort has been expended. It is, of course, impossible in this discussion to disassociate the effect of the nursing service from that of the other activities of the Company and from the results of the public health work of the communities. The extensive distribution of the Company's educational literature, the coöperation with health officers and the very excellent activities of so many of the local and state departments of health, have all played an important part in determining the favorable returns. But the country-wide extension of the nursing service to include over two hundred thousand patients annually, the intensive work done often in the nature of emergent relief, the education in personal hygiene which follows the more than a million visits made by the nurses to industrial homes, together must be credited with a large share in the mortality reduction which we have described above. In no other way can we explain the much more favorable condition which prevails among the insured than among the general population.

REVIEWS AND NOTES.

An Introduction to Statistical Methods. By Horace Secrist, Ph.D. New York: The Macmillan Co., 1917. Pp. VIII, 482.

Into a field that has been demanding adequate treatment for some time, the entry of Professor Secrist's book is most welcome. The author emphasizes the study of statistics as a method and a means, rather than an end in itself, and addresses himself to three classes of readers: college students, statisticians, and business executives. As a manual for statisticians, the volume carries much valuable information and is most suggestive; the reviewer is inclined to question, however, whether the book will at all points be clear to the other two classes.

The author displays wide reading, and handles his material with skill. He is particularly to be commended for devoting his main attention rather to business or economic statistics than to vital statistics, which, although an important branch of statistics, is becoming of lesser interest to general students of statistical method. For example, the discussion of the lack of coördination in much of the statistical effort of today (pp. 33–37), and of the nature of statistical units (pp. 59–63), shows commendable familiarity with and emphasis upon the growing field of economic statistics.

On the other hand, is it wise to fill a book—even one dealing with method—with so much detail as to the statistical activity of governmental bureaus? I refer to the description of existing wage statistics and their tabulation (pp. 94–104). Again, condensation would have improved such other sections as the detailed discussion of American index numbers (Chap. X, in part) the discussion of methods of ascertaining the arithmetic mean, and some of the longer tables on correlation, such as Tables E and F.

The first three chapters are admirable for the statistical beginner. They deal with the meaning and application of statistics, with the collection of data, and with units of measurement. Chapters V, VI, and VII, dealing with tabular and graphic presentation, are also helpful. Chapter IV is an illustrative section on statistical method, using the subject of wages as typical. The discussions of averages and index numbers, Chapters VIII and IX, introduce some material that is over the heads of the average student or business man, the same being true in larger measure of the remaining chapters, especially the discussion of dispersion and skewness and of correlation.

Furthermore, doubt may be expressed whether some of the definitions and discussions are sufficiently clear for the beginner in statistics. Take, for instance, the discussion of how to smooth a curve or graph (pp. 229–231), and the brief reference to interpolation (p. 270). These are matters clear enough to the practicing or professional statistician; it is questionable, however, whether a representative college student or business man would gain a clear conception of them from the discussion. This seems all the more unfortunate, as the general arrangement of the volume is excellent, the chapters are carefully arranged and well annotated, and there is a consistent effort throughout to state the problems as introduced and to summarize the conclusions of each chapter.

Again, the distinction between *diagrammatic* and *graphic* presentation (Chaps. VI and VII) seems loosely drawn for the beginner. In fact, there is no direct definition of either method of presentation. The nearest approaches to a definition of diagrammatic presentation are the two statements that "diagrams are generally illustrations of conclusions from analysis" (p. 159), and that they represent an effort "to introduce devices for showing the proportional relations between facts, and to emphasize the concepts of space and movement" (p. 162). Graphic presentation is stated to deal "with graphs or curves of various types which show the distribution of data at a given time or the sequence of data over a period of time" (p. 193). The graphic method is further described as more inclusive than the diagrammatic, because graphs "may be used advantageously in connection with averages and other summary expressions" (p. 158), and because they emphasize continuity and relation more strikingly than diagrams in that they are uninterrupted (p. 193). Is it meticulous to suggest that these distinctions as stated may leave the beginner in a state of mental confusion?

A few omissions and inconsistencies may be noted. In treating of the utilization of statistics within business units (p. 11) there is no reference to an income account or a balance sheet—a rather curious omission of perhaps the most significant of all corporate statistics. They are accounting statistics, it is true, yet they also represent a high level of statistical method. In the discussion of mechanical systems of tabulation on page 127, a typographical error misspells the name "Hollerith." The author discusses the wage statistics of the Interstate Commerce Commission (pp. 94–95), but overlooks the latest developments, made effective July 1, 1914, by which railway employees are now classified in 68 groups, while their compensation is reduced to an hourly rather than a daily basis. Reference to the Commission's statistical report for 1915 would have obviated this oversight.

However, these are insignificant slips of the pen in a work that displays sound scholarship and wide application of existing material. The book contains much of value for the student, if he knows how to skip details; much good reference material for the statistician; much food for thought for anyone interested in current methods of statistical tabulation and presentation. It is a distinct contribution and may especially be commended to readers of these QUARTERLY PUBLICATIONS.

J. H. P.

A NOTE ON KING'S ARTICLE ON "THE CORRELATION OF HISTORICAL ECONOMIC VARIABLES AND THE MISUSE OF COEFFICIENTS IN THIS CONNECTION."

Errors in the conception of correlation and the use of the correlation coefficient are so common a vice of pseudo-scientific research that any attempt to correct their influence would be a bootless task. Mistakes of this sort mark the beginnings of any newer branch of scientific knowledge and may be looked upon as natural growing pains. Were Dr. King's article in the December number of the Quarterly Publications the first fruit of an immature worker in an uncultivated field, it might be allowed to pass without comment. But Dr. King's standing among American statisticians and the appearance of his article in the publications of the American Statistical Association place the matter in a different light, and justify an explicit challenge to the contentions he sets forth.

The gist of Dr. King's argument runs as follows: (1) the correlation coefficient is being employed to demonstrate utterly fallacious conclusions, especially in the analysis of historical data; (2) such errors rest in part upon neglect of the fact that correlation always indicates causation; (3) in part the errors are due to failure to separate adequately the forces contributing to the given events; (4) if causal forces are thoroughly isolated, correlation in every case will be perfect; (5) for demonstrating whether correlation does or does not exist, "no coefficient equals the graphic method"; (6) in the study of historical economic variables, the correlation coefficient serves but one purpose—namely, to measure the lag, if there be any.

One need not question Dr. King's contention that the correlation coefficient has been too often employed to support conclusions which have been "utterly fallacious and entirely contrary to the facts." Few statistical devices are "foolproof," and the more delicate the device the more liable it is to misuse by the inexpert. Dr. King's indictment, however, might well have been made more specific. Blundering by the novice is one thing; error by the scientist is another. One can not but feel that much of Dr. King's bill of complaint is irrelevant to the work of statisticians of measurable professional standing. If this be the case, the fact might well have been made clear.

But it is in his analysis of correlation and the correlation coefficient that Dr. King is most unfortunate. His discussion of the nature of correlation is so extreme and inflexible as to be wholly misleading. To Dr. King, correlation invariably connotes established causal relationship. Since "every cause must produce its effect exactly and invariably," it follows that "there can be no such thing as imperfect or partial correlation." "Every correlation to exist must be perfect." Correlation coefficients less than unity indicate that cause and effect have not been completely isolated; they evidence the confusion or deficiency of our measurements, not any imperfection of the correlation itself.

If correlation were being defined *de novo*, it is possible that this view might prevail. But the term "correlation" has an established meaning.

Correlation is not identical with causation, though closely connected with it. Correlation connotes a tendency toward persistent association. In other words correlation is "a tendency toward concomitant variation." As Bowley states it (Elements of Statistics, p. 316): "When two quantities are so related that the fluctuations in one are in sympathy with the fluctuations of the other, so that an increase or decrease of one is found in connection with an increase or decrease (or inversely) of the other, and the greater the magnitude of the change in the one, the greater the magnitude of the change in the other, the quantities are said to be correlated." By established usage and authority, correlation is nothing more than "one-to-one" correspondence in paired items of selected variables.

If this is the nature of correlation, what is its relation to causation? The case of perfect correlation may be first considered. Perfect correlation is a theoretical or conceptual limit to the more or less imperfect correlations of the world of experience.* Actual correlations, nevertheless, sometimes approach perfect correlation so closely as to share its nature. Such approximately-perfect correlations afford indisputable evidence of (1) joint characteristics of single entities (*e. g.*, the height and weight of adult males), or (2) that consistent routine of events which we designate causal connection. Complete correlation in the first of these cases informs us that we may expect to find invariably associated with a given characteristic of an object a stated measure of a second characteristic. Complete correlation in the second case informs us that we may expect to find a given event—designated cause—invariably followed by a second—designated effect.†

If correlation were always perfect, the problem would be relatively simple. Unfortunately for Dr. King's exposition, data drawn from experience—even artificially controlled experience—never exhibit perfect correlation. The essential task of correlation studies lies in the interpretation of concrete evidence, not in the understanding of conceptual limits. In general the question raised by actual data is a question of probability: Do the data show a degree of correspondence greater than was to have been expected from chance? If not, there is no evidence of a tendency toward persistent association, and hence no evidence of correlation. If the degree of correspondence, however, exceeds that which was to have been expected from chance, correlation may be postulated with a confidence varying directly as the excess.

It is clear enough that, when cause and effect are absolutely segregated, correlation becomes complete and obvious. Such complete—or virtually complete—segregation of forces is the ideal of causal analysis. Dr. King cites three reasons for the failure of economic analysis to attain this ideal: (1) failure to comprehend the factors involved; (2) lack of information essential to the separation of the forces; (3) ignorance of proper statistical methods. Unfortunately he neglects the reason which is most fundamental: the practical impossibility of isolating economic forces completely. Dr. King, in suggesting the complete segregation of forces in economic analysis, is not merely giving a counsel of perfection; he is proposing what is manifestly impossible. The events of economic life are the product of an intricate, complex, maelstrom of forces. Economic science is replete with examples of the misfortunes attending attempts to abstract influences from this social complex: what the analysis gains in simplicity, it loses in reality and applicability. Segregation of forces in economic analysis must be effected with the utmost care, and can never be more than partial.

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* An analogous statement may be made, of course, of perfect independence.

† Conceivably the joint characteristics of the first case may be thought of as coupled effects of a common cause; thus bringing the case within the class of causal connections. But ordinarily nothing is to be gained by this view of the matter. Whether or not the two cases at bottom are alike causal, their separation in practice is helpful.

Dr. King makes much of a parallel between the methods of economic and physical science. Unquestionably economic research might profit greatly from wider and more intimate acquaintance with the methods of the more exact sciences. But a warning should be given against the tendency of making research in social science an exact and mechanical process. It is unsafe to conduct economic studies with mathematical automatons. In the first place, in most cases the original measurements are not sufficiently accurate to justify refined methods of analysis. And secondly, the analysis itself is a succession of acts of selection and interpretation calling for the highest order of intelligence. If left to itself, statistical method soon runs amuck. If it is to be successful, there must be wise and steadying guidance. Nothing is more mistaken than the widely-held notion that statistical method, because of the precision of its mathematical processes, yields perfectly dependable results. It is to be hoped that statistical method will make the hypotheses of economic science somewhat more trustworthy; for with the aid of this method *presumptions* of causal connection may surely be more firmly established. But it is one of the unavoidable limitations of economic science that its laws must remain openly in the presumptive form. Fortunately the laws may be made to serve none the less as satisfactory working hypotheses for private and public policy.

Nothing that has been said should be construed as in opposition to as thorough a separation of forces as is practicable in economic analysis. In the study of time series, secular trend, cyclical movements, and seasonal fluctuations should be carefully distinguished. Data should be selected with a view to their "greatest possible homogeneity." Studies of correlation should be supplemented with studies of "partial correlation." Unfortunately these latter practices, involving as they do a restriction of the "universe of discourse," sacrifice wealth of material to uniformity of data, and by basing conclusions necessarily upon a smaller body of evidence increase the probable error of the result. When all is said and done, a large margin of uncertainty thus is bound to persist in economic science. Much more is to be gained by acknowledging this fully than by underrating its significance.

Dr. King's argument leads him to discount the use of the correlation coefficient. If all correlations were perfect, he could well afford to do so; perfect correlation, if actually encountered, would be simple enough to deal with. It is just because correlation is never perfect that the coefficient is invaluable. As has been stated, the significance of a given association of paired variables depends entirely upon the extent to which the association exceeds that to be expected from chance. The correlation coefficient enables an exact measurement of this all-important relationship. For this purpose curves are worthless. Curves may yield valuable suggestions for further study; they may prove effective graphic representations of correlation. In general they are a treacherous instrument for *proving* correlation. For this purpose nothing equals the correlation coefficient.

In the analysis of time variables, Dr. King would limit the use of the coefficient to the measurement of lag. Nothing could be more ill-advised. It is true that the correlation coefficient in its original form was not adapted to the study of fluctuations in time. But the "method of differences" corrects this deficiency and restores the coefficient to its position as the most serviceable measure of correlation, for historical as for other variables.

It is difficult to say to what extent the defects of Dr. King's article arise from mere excess of statement in giving a warning, the need of which all might concede. Dr. King's contributions to the literature of statistics are a sufficient guarantee that we need fear no abuse of statistical method at his hands. Unfortunately his December article gives no equal assurance for others. Upon the contrary there is reason to believe that it will add materially to that confusion regarding the nature of correlation and the correlation coefficient which it has been Dr. King's intention to correct.

EDMUND E. DAY.

NEW SERIES, No. 123. (VOL. XVI.) SEPTEMBER, 1918.

QUARTERLY PUBLICATIONS OF THE AMERICAN STATISTICAL ASSOCIATION.

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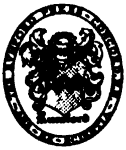

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 123. SEPTEMBER, 1918

OUR MEMORIAL VOLUME.

By WESLEY C. MITCHELL, *President of the American Statistical Association.*

The American Statistical Association passed its seventy-fifth birthday on the 13th of February, 1914. To celebrate that anniversary the Association decided to prepare a history of official statistics in the principal countries of the world. Mr. John Koren, then our president, undertook the arduous duty of collecting and editing the contributions.

The Memorial Volume thus planned has but recently appeared. In February, 1914, no one foresaw the tragic events which have rendered the editor's task so difficult, and have delayed its completion so long. But neither did anyone then foresee the peculiar significance which these events would lend the volume.

Official statistics, several of the contributors remind us, have had a longer and more chequered history than we commonly remember. Professor Faure, in his admirable paper upon French experience, begins with the *polyptiques* of Pepin the Short. Sir Athelstane Baines begins the English article with Domesday Book. In the centuries since these medieval beginnings there are many landmarks pointed out in the progress of European statistics. Even the writers on the newest countries have to divide their stories into "periods." But though recognized in the development of every country's statistics these "periods" seldom coincide in any two cases. Now, however, we are passing through years that will mark a turning-point in the history of statistics in every great nation in the world.

Imperious necessity is driving all nations, neutrals as well as belligerents, to organize their economic life with a new thoroughness. How much food do the people require, how much do they raise, how much must they import? Similar problems thrust forward in respect to every great staple, in respect to railways and ships, ports and factories, capital and labor. Foreign resources are scanned not less anxiously than domestic. In every capital city there are men raging over the deficiencies of the statistical data provided by other countries. In every capital responsible statesmen are wondering how far they dare trust their own familiar figures, and demanding in haste data that have never been gathered. New statistical bureaus with inquisitorial powers and large resources are being set up to meet emergency calls. Very different from what they were in 1914 will be the statistical organizations on the return of peace.

Our Memorial Volume brings the story of statistics in most of the leading nations down to the outbreak of war. Better than any other book it sums up the accomplishments of the day that has passed. That gives it unique historical value.

But the volume has a larger service to render than that of recording what has been. It will also help in shaping what is to be in the future. Statistics is an international enterprise. Washington is concerned both with the statistical output and with the statistical methods of London, Paris, and Berlin, of Buenos Ayres, Wellington, and Tokyo. The officials of every country that is striving to improve its statistical service will wish to survey the procedure of other lands. There may be few occasions for exact imitation of a foreign model, but there are many occasions for seeking hints. Perhaps no one entrusted with a task of statistical re-organization can stop with the information found in our Memorial Volume; but no one can find a better book with which to begin.

In these days of stress the American Statistical Association has an unprecedented number of its members enrolled in the nation's service, many of them at heavy personal sacrifice. Perhaps this work for the country will involve a temporary slackening in the Association's corporate activities. But statistical methods are demonstrating so forcibly their utility as a solvent of administrative perplexities that we may feel every confidence in the future not only of the science but also of the Association that fosters it. In the meantime we are fortunate in having the Memorial Volume to remind us what the Association has accomplished in the past and what it should strive toward in the future.

THE RELATION BETWEEN BIRTH RATE AND DEATH RATE IN A NORMAL POPULATION AND THE RATIONAL BASIS OF AN EMPIRICAL FORMULA FOR THE MEAN LENGTH OF LIFE[*] GIVEN BY WILLIAM FARR.

By Alfred J. Lotka.

Both birth rate and death rate are, for obvious reasons, functions of the age-distribution in a given population.

A certain interest attaches to this circumstance from several points of view.

It is of interest to the statistician who seeks to "correct" the so-called "crude" death rates so as to bring them to a definite and common standard for purposes of comparison.[†]

Secondly, the subject is of interest in connection with certain problems of biochemistry, the growth of certain colonies of living organisms having been found to take place in accordance with the law of monomolecular reactions. As has been pointed out by Eijkman,[‡] the question there arises, how this law of growth can be harmonized with the influence of the age-distribution on birth rates and death rates.[§]

Thirdly, the relation between age-distribution and birth and death rates is of interest in connection with the mathematical theory of evolution. For a quantitative measure of the "fitness" of a given type of organism, or of its "adaptation to given conditions," is given in its rate of growth under those conditions.[‖] But this rate of growth depends, not only on the fundamental characteristics of the species, but also on a factor which, from this point of view, must be regarded as purely adventitious, namely the age-distribution among the individuals of the species.

---

[*] Expectation of Life at birth.

[†] Cf. G. H. Knibbs, The Establishment of a Series of Norms for Death Rates. Trans. XV. Internat. Congr. Hyg. and Demogr. (1912), v. VI, p. 343; Knibbs & Wickens, The Establishment and Use of Population Norms, etc. *Loc. cit.* p. 352.

A. J. Lotka. A Natural Population Norm. Jl. Washington Ac. Sc. 1913, v. 3, pp. 241, 289.

[‡] Cf. C. Eijkman, On the Reaction of Velocity of Organisms. Proc. Amsterdam Ac. Sci., 1912, p. 629; Reichenbach. Zeitschr, f. Hyg. u. Inf. Krankh, 1911, v. 69, p. 171; Wo. Ostwald, Uber die Zeitlichen Eigenschaften der Entwickelungsvorgänge, Leipsic, 1908; T. B. Robertson, On the Normal Rate of Growth of an Individual, Arch. f. Entwickelungsmechanik 1908, p. 108.

[§] In ordinary chemical reactions and radioactive transformations this question does not arise, as the "force of mortality" of a species of molecules is independent of the age of the molecules. See A. J. Lotka, Am. Jl. Sci., 1907, v. 24, p. 205.

[‖] Cf. A. J. Lotka, Am. Jl. Science, 1907, v. 24, p. 216; Ann. Nat. Phil., 1911, p. 59; Jl. Wash. Ac. Sci., 1912, pp. 2, 49, 66; 1915, pp. 360, 397.

The problem here arises of eliminating this adventitious factor from the case under consideration.

Fortunately it very largely eliminates itself by a spontaneous process: It is evident that the age distribution in a population is not fortuitous. It is capable of variation and fluctuation, but not without all rule and beyond all bounds. In point of fact, in an isolated population, where emigration and immigration are absent or negligible, the age-distribution tends to approach a certain definite normal type,[*] and when this is attained a relation between birth rate and death rate exists which no longer explicitly involves the age-distribution. Such a population behaves as if its birth rate and death rate were independent of the age-distribution, and grows and diminishes according to the exponential law or the law of geometric progression,[†] the same law which governs the progress of a monomolecular chemical reaction. There would therefore seem to be no occasion for surprise at the observation discussed by Eijkman, *loc. cit.*, that the growth of certain organisms follows this law irrespectively of the age-distribution in the colony.

While in practice the "normal" age-distribution may be more or less closely approached, it will, for obvious reasons,

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[*] Cf. Poynting & Thomson, Text-book of Physics, Volume on Heat, 1904, p. 135; A. J. Lotka, Am. Jl. Sci., 1907, v. 24, p. 201; Science, 1907, v. 26, p. 21; Jl. Wash. Ac. Sci., 1913, pp. 241, 289; Sharpe & Lotka, Phil. Mag., April, 1911, p. 435.

[†] Cf. also M. Block, Traité de Statistique, 1886, p. 209; A. J. Lotka, Am. Jl. Sc., 1907, v. 24, p. 201.

It is evident that the birth rate and death rate can be *actually* independent of the age-distribution only if the force of mortality is independent of the age, *i. e.*, in the notation of equation (1) in the text, p. 123, if

$$\begin{aligned} p(a) &= e^{-ka} \\ k &= \text{const.} \end{aligned}$$

When the age-distribution is fixed, and the population *behaves as if* its death rate were independent of the age-distribution, we can speak of an *equivalent constant force of mortality*, the value of which follows from equation (4), Am. Jl. Sc., 1907, v. 24, p. 200, viz:

$$\begin{aligned} d &= -\int_0^\infty c(a) \ \frac{d \log p(a)}{da} \ da \\ &= k \int_0^\infty c(a) \ da \\ &= k \end{aligned}$$

so that the equivalent constant force of mortality is numerically equal to the death rate per head.

never be exactly attained in any real population. But for the purposes of theoretical discussion, where we wish to eliminate from consideration the influence of the adventitious factor of age-distribution, it is convenient to base one's reflections on the example of an ideal population in which the "normal" age-distribution is established. This is all the more legitimate, since it has been shown that in practice this age-distribution may at times be very closely approached.[*]

A roughly approximate expression for the relation between the birth rate and death rate in a population which is increasing in geometrical progression (and in which, therefore, the age-distribution is normal) has been given by Bristowe.[†] This expression is derived on the assumption that each individual attains the mean length of life, and is quite inexact.

The exact relation between the birth rate and death rate in a normal population has been given by the author[‡] in the form

$$\frac{1}{b} = \int_0^\infty e^{-ra} \quad p(a)da \tag{1}$$

where

b = birth rate per head per annum
r = natural rate of increase per head per annum
$= b - d$
d = death rate per head per annum
$p(a)$ = probability at birth of reaching age a (tabulated in the life tables and there commonly denoted by the symbol l_x).

Equation (1) expresses the relation between b and d in implicit form and is inconvenient for purposes of numerical computation.

In a later publication[§] another expression was therefore derived from (1) by expanding e^{-ra} under the integral sign and integrating term by term.

The formulae thus obtained give the relation between b and r and d and r in explicit form and offer certain advantages for purposes of computation, but are still somewhat complicated, since the series converge, for common values of r, at such rate as to necessitate the retention of five or six terms, and the somewhat laborious determination of a corresponding number of constants.

---

[*] A. J. Lotka, Jl. Wash. Ac. Sc., 1913, pp. 243, 244.

[†] St. Thomas' Hosp. Report, 1876, quoted in Newsholme, Vital Statistics, 1899, p. 295.

[‡] Am. Jl. Sci., *loc. cit.*

[§] Jl. Wash. Ac. Sci., 1913, pp. 241, 289. Equations of the form (1) have also been dealt with by Pincherle, Mem. Bologna Ac. Sc., 1887, v. 8, p. 10; Bateman, Proc. Cambridge Phil. Soc., 1910, v. 15, p. 424.

A very much simpler form of the relation between b and d in a normal population, which holds with a very fair degree of approximation, has now been found, suggested by some reflections on an empirical (approximate) formula for the mean length of life quoted by Newsholme and attributed by him to Farr.[*] At the same time, following up this clue, an insight was gained into the *raison d'être* of Farr's empirical formula.

Farr showed that during the decade 1881–1890, the birth rate and death rate in England and Wales were related to the mean length of life[†] L very nearly according to the equation

$$\frac{1}{3}\cdot\frac{1}{b}+\frac{2}{3}\cdot\frac{1}{d}=L \tag{2}$$

This equation is of the form

$$\frac{P}{b}+\frac{Q}{d}=L \tag{3}$$

or

$$\frac{p}{b}+\frac{q}{d}=1 \tag{4}$$

By a simple transformation, we have, from (4)

$$(b-p)\ (d-q)=pq \tag{5}$$

which would indicate that for a given value of L the relation between b and d is, as a first approximation, hyperbolic in form.

Indeed, a glance at curve I in the accompanying figure, which is drawn in accordance with the data published by the writer in his paper on *A Natural Population Norm*, confirms this indication at least qualitatively. This curve shows the graph of the relation

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[*] Newsholme, Vital Statistics, 1889, p. 301.

[†] For further discussion of the relation between the mean length of life and the rate of increase of a population see W. J. Spillman, Science, 1912; republished, with editorial note by the present writer, in Sci. Am. Suppl., 1912, p. 378.

$$\frac{1}{b}=\int_0^\infty e^{-(b-d)a}\quad p(a)da \tag{1a}$$

$$=\int_0^\infty e^{-ra}\quad p(a)da \tag{1}$$

for the decade 1871–1880 in England and Wales.

To obtain further light on this point, we proceed as follows: Equation (1a) is an implicit relation between b and d.

We may write it in the form:

$$\frac{1}{b}=F_1(r) \tag{6}$$

$$\frac{1}{d}=F_2(r) \tag{7}$$

whence, by eliminating r between (6) and (7) we should obtain

$$\frac{1}{b}=F_3\left(\frac{1}{d}\right) \tag{8}$$

Now F_1 and F_2 are known in the form of series, can, in fact, be obtained by expanding e^{-ra} under the integral sign in (1) and integrating term by term. The value of the coefficients of successive powers of r can be determined by mechanical quadrature when $p(a)$ is given in form of a life table and r is known.

We thus obtain, for England and Wales, 1881–1890

$$\frac{1}{b}=L+Ur+Vr^2+Wr^3+\quad . \; . \; . \tag{9}$$

$$\frac{1}{d}=L+ur+vr^2+wr^3+\quad . \; . \; . \tag{10}$$

Neglecting terms in r^2 and higher powers of r, and eliminating r between (9) and (10) we have:

$$\frac{u}{b}-\frac{U}{d}=L(u-U) \tag{11}$$

$$\frac{u}{u-U}\cdot\frac{1}{b}-\frac{U}{u-U}\cdot\frac{1}{d}=L \tag{12}$$

an equation which corresponds in form to Farr's formula (2) or its generalizations (3) and (4). This correspondence extends not only to the general linear form but also to the fact that the sum of the coefficients of $\frac{1}{b}$ and $\frac{1}{d}$ in (12) is unity, just as in Farr's formula (2).

NUMERICAL DATA.

1. Farr applies his formula to the period 1881–1890 (England and Wales).

The writer has determined by the method indicated in his paper cited above the coefficients u, U. There is first obtained

$$b = .02200 + .7130r + 6.766r^2 - 17.47r^3 + \quad . \; . \; . \tag{13}$$

$$d = .02200 - .2870r + 6.766r^2 - 17.47r^3 + \quad . \; . \; . \tag{14}$$

This gives, neglecting the terms in r^2 and r^3,

$$\frac{1}{d} = 45.45 + 593.0r + \quad . \; . \; . \tag{15}$$

$$\frac{1}{b} = 45.45 - 1473r + \quad . \; . \; . \tag{16}$$

$$.713 \, \frac{1}{d} + .287 \, \frac{1}{b} = 45.45 \tag{17}$$

so that we have for the mean length of life

$$L = .713 \, \frac{1}{d} + .287 \, \frac{1}{b} \tag{18}$$

The observed mean values of b and d during this period were

$$\left.\begin{aligned} b &= .03234 \\ d &= .0190 \end{aligned}\right\} \tag{19}$$

Substituting these in (18) gives

$$L = 37.5 + 8.8 = 46.3$$

Observed	$L = 45.5$
Discrepancy	.8

Farr's formula gives

$$L = 45.6$$

an exceedingly close fit, which, however, is undoubtedly accidental.

2. For the period 1871–1880 the author's previous work furnishes detailed data for the male population.

It appeared of interest to recompute the graph of the relation between b and d by the hyperbolic formula (12) and compare it with the graph of the more exact relation (1) previously plotted.

The numerical data in this case are as follows:

$$b = .02418 + .7673r + 6.823r^2 + \quad . \quad . \quad . \qquad (20)$$

$$d = .02418 - .2327r + 6.823r^2 + \quad . \quad . \quad . \qquad (21)$$

This gives

$$.767 \frac{1}{d} + .233 \frac{1}{b} = 41.35 \qquad (22)$$

This, written in hyperbolic form, gives

$$(b - .00563)\ (d - .01855) = .00010443 \qquad (23)$$

or, putting

$$B = b - .00563 \qquad (24)$$

$$D = d - .01855 \qquad (25)$$

we have

$$BD = .00010443 \qquad (26)$$

Table I below shows, for successive arbitrarily chosen values of b, the corresponding values of d calculated by (23), and, for comparison, also the corresponding values of d calculated by (1). For comparison also there are shown in the last two columns the corresponding products BD. The hyperbolic formula, of course, makes this product constant. The series formula gives a certain departure from constancy, which on inspection was found to be approximately equal to $-2r^3$.

This suggested a simple empirical formula which gives a very close approximation to the theoretically exact relation (1), namely

$$(b - .00563)\ (d - .01855) = .00010443 + 2r^3 \qquad (27)$$

or

$$(b - .00563)\ (b - r - .01855) = .00010443 + 2r^3 \qquad (28)$$

a relation which enables us to compute a series of values of b corresponding to given values of r. The corresponding values of d then follow directly in view of the relation $(b - d) = r$.

TABLE I.

I b	II d exact	III d hyperb.	IV* $BD \times 10^8$ exact	V* $BD \times 10^8$ hyperb.
.040	.02197	.02158	11754	10443
38	2205	2178	11329	10443
36	2217	2190	10994	10443
34	2234	2223	10752	10443
32	2256	2251	10574	10443
30	2284	2284	10454	10443
28	2322	2322	10447	10443
26	2368	2368	10450	10443
24	2423	2424	10434	10443
20	2574	2582	10332	10443
16	2796	2862	9758	10443
12	3125	3495	8090	10443
.008	3603	.06262	4143	10443

* $\begin{cases} B = b - .00563 \\ D = d - .01855 \end{cases}$

TABLE II.

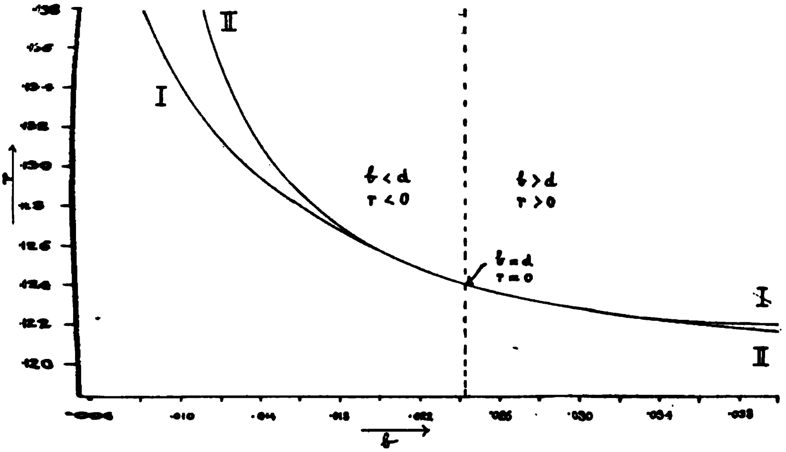
I r	II b exact	III b corr. hyp.	IV d exact	V d corr. hyp.	VI $BD \times 10^8$ exact	VII $BD \times 10^8$ corr. hyp. $= 10443 + 2r^3 \times 10^8$
.01803	.040	.04000	.02197	.02197	11754	11615
1595	38	3798	2205	2208	11329	11258
1383	36	3599	2217	2216	10994	10972
1166	34	3400	2234	2234	10752	10760
0944	32	3201	2256	2257	10574	10609
0716	30	3002	2284	2286	10454	10516
0478	28	2801	2322	2323	10447	10465
0232	26	2600	2368	2368	10450	10446
−.00023	24	2400	2423	2423	10434	10443
− 574	20	2003	2574	2577	10332	10405
− 1196	16	1617	2796	2813	9758	10101
− 1975	12	1225	3175	3200	8408	8902
−.02803	.008	.00799	3603	3602	4143	6039

Table II above shows, for the values of r corresponding according to equation (1) to successive entries in Table I, the values of b and d calculated both by the exact formula (1) and also by the corrected hyperbolic formula (28). The last two columns show the product BD as given by the exact formula (1) and also by the corrected hyperbolic formula (28). A comparison of columns II, III of Table I shows that, except for extremely small values of b, the hyperbolic formula gives very fair agreement with the exact formula.

On the other hand columns II, III and IV, V of Table II show an almost perfect agreement, which is somewhat remarkable in view of the empirical nature of the very simple correcting term $2r^3$.

The same features are brought out graphically in the accompanying figure which needs no further explanation beyond that furnished in the caption.

The agreement between columns II, III and IV, V of Table II is so close that there is no object in showing the corresponding curves. They would practically coincide within the errors of drawing.



CURVE I. GRAPH OF $b = \frac{1}{\int_0^\infty e^{-(b-d(a} p(a)da}$

CURVE II. GRAPH OF $.767 \frac{1}{b} + .233 \frac{1}{d} = 41.35 = L$

or $(b - .00563)\ (d - .01855) = .00010443$

Note that within the region of commonly occurring values of b and d the two curves are nearly coincident.

To the left of the dotted vertical line the death rate exceeds the birth rate, so that the population is diminishing. The marked divergence of curves I and II on the extreme left is of no practical significance, since such rapid rates of decrease as here represented can not long continue, if they occur at all, in any real population.

Summary:

The implicit relation between birth rate per head b and death rate per head d

$$\frac{1}{b} = \int_0^\infty e^{-(b-d)a} \quad p(a)da \qquad \text{(I)}$$

which was developed in a previous paper, is now shown to be equivalent to the explicit hyperbolic relation

$$(b-p)\ (d-q) = pq = \text{const} \qquad \text{(II)}$$

in the neighborhood of $b-d=0$ and for values of b and d such as occur in practice.

The hyperbolic relation (II), expressed as a relation between $\frac{1}{b}$ and $\frac{1}{d}$, assumes the linear form

$$\frac{u}{u-U}\cdot\frac{1}{b}-\frac{U}{u-U}\cdot\frac{1}{d}=L \tag{III}$$

which is of the same form as Farr's empirical rule for the mean length of life L, viz.:

$$\frac{1}{3}\cdot\frac{1}{b}+\frac{2}{3}\cdot\frac{1}{d}=L \tag{IV}$$

The empirical constants $\frac{1}{3}$ and $\frac{2}{3}$ which occur in Farr's rule thus receive a rational interpretation.

OCCUPATIONAL PROPINQUITY AS A FACTOR IN MARRIAGE SELECTION.

By DONALD M. MARVIN.

The presence of a large and increasing number of women in industry raises the question of the possible influence of industry upon marriage selection. Modern social conventions are based upon the presumption that woman is shut away in the home and that man must follow her there if he wishes to see her. In entering industry in such large numbers, women face two new conditions, one negative, the other positive. They leave the home temporarily empty and they create a new social phenomenon of occupational propinquity. This, modified by the various influences of class stratification, financial status, and other forms of group cohesion involved in the present organization of society, tends to differentiate certain groups of men and women for marriage.

Industrial propinquity extends to the home and to the economic status. Even class and race lines enforce occupational cohesion. Such stratification and drawing together of certain parts of social groups must react variously upon those involved. It seems possible that friends who marry within their own occupation are not so much guided by similar tastes and backgrounds as they are driven by a new force of industrial propinquity, a force that has developed with the appearance of woman in industry.

Marriage, a matter of individual choice, if choice exists, obeys the sweeping silent force of propinquity. Women in each occupation are surrounded by the men of the same occupation. Of course they marry these men. This inevitable sequence causes no astonishment.

Today the most attractive as well as the strongest and most vigorous women are in industry. Their presence has been accepted and the taboo has been removed. The result is that men are now marrying the women whom they meet in their work. The tremendous proportions of this movement are of startling and far-reaching significance.

Today we are confronted with tremendous numbers of women in industry and this environment must react upon all phases of their lives. Not the least important aspect of this general situation is the fact that the occupation seems to select certain groups of people for acquaintance and for eventual marriage through propinquity within the shop or factory.

To the extent that women are a factor in modern industry, industry may affect their lives. Industrial propinquity must be a factor in marriage selection in proportion to the number of women employed in industry. The report of the United States Census on Occupations for 1910 shows that there are four times as many women in industry as there were in 1880. With the tremendous acceleration of this movement due to the war, it is quite possible that the number will have doubled between 1910 and 1920. There are over 200,000 women employed in the industries of Philadelphia alone. Twenty-three and four tenths per cent. of the women of the country are engaged in gainful occupations and are therefore exposed to whatever influence occupation may have upon marriage. Of the unmarried women of marriageable age in an industrial city like Philadelphia, a far larger proportion are gainfully employed. In fact, 50 per cent. of the marrying women of Philadelphia are employed at the time of marriage.

The constant mingling of men and women within an occupation causes such constant sex stimulation as to exert a determining influence upon marriage selection. The effect of a particular occupation upon a woman and upon her chance of marriage is more directly the problem of this thesis. The professional woman may serve as an example. When a woman physician marries a man physician, as seven out of ten such Bryn Mawr alumnae actually did, a new type of home environment is the result. The ethics and ideals of the profession become table talk and professional ambitions and desires are not hedged about by office hours. Such an atmosphere inevitably affects the children. If this were a matter of isolated cases, it might be dismissed as of no importance, but already it concerns half the women being married today.

The problem, then, is the extent and constancy with which industry affects marriage. The first measure of this influence will be the extent of intermarriage within the occupation. It is necessary therefore to discover the actual number of marriages that are occurring between the men and women engaged in the same occupations. A method must then be found to determine the number of marriages that would take place within the occupation were marriage merely a matter of chance. Finally, the number of marriages within the occupation must be compared with the results calculated as a matter of chance in order to show whether or not industry has been an appreciable factor.

It was decided that the only acceptable data would concern the occupation of the man and woman at the time of marriage. An investigation of applications for marriage licenses in the various cities of the country showed a great mass of material that has never been digested. As Philadelphia is a typical city with a mixed industrial population and as the most complete information has been collected here, the investigation was limited to this city.

The data were derived from the books of the Marriage License Bureau in City Hall in Philadelphia. All licenses in the available books were used. They include practically all licenses issued in Philadelphia for the three years from June, 1913 to June, 1916. The numbers run from 299,758 to 332,586 and from 332,601 to 340,900 and from 341,401 to 355,367. The only exceptions made were those of Negroes, none of whom were counted. Throughout the work here and there a license was skipped because it related to a colored couple. This omission was made with the purpose of refining the statistics.

The grouping of occupations of the United States Census was used in a preliminary study of a thousand cases. Of these thousand cases 541 women worked and of these 275, more than half, married men in the same occupation. Of the thousand men more than 25 per cent. married into their own occupation.

In order to treat the matter at all, it was necessary to group the occupations. The groups selected were very carefully defined and the name of the group shows the type of person employed.

None
Agriculture
Clothing
General Factory
Drivers
Telegraph and Telephone
Retail Trade
Clerical
Professions
Personal Service
Managers and Superintendents
Firemen and Engineers
Miscellaneous
Unknown
Provisions
Textiles
Artisans
Railroads and Street Railroads
Finance
Clerks
Public Service
Semi-Professions
Domestic Service
Unskilled Labor
Printing

Those in the class marked None are principally women living at home, but it also includes women who gave their occupation as housework. Under Unknown are four men and no women.

It is possible that more women are gainfully employed than these statistics show. A woman expecting to marry frequently gives her occupation as housework. This was a source of error. For example, the wife of a railroad president gave her occupation as housework. As she is a well-known society woman there could be no question of her being a domestic. For this reason it was decided to place all cases of housework in the group None. The result is that a great many domestics and some other women who were really at work are included among the group whose occupation is given as None.

Clerks are of two groups. The term clerk should not include salesmen. However, little effort is made in the Marriage License Bureau toward clear definition of occupation, and the result is that both salesmen and those belonging to the real clerical occupations are included in the group Clerks.

The desired information was coded into numbers according to a decimal system. The numbers used for the occupations were those standardized by the United States Census Bureau in their "Index of Occupations." These numbers and others representing the age and nationality of the couple and their parents were punched into tabulating cards to be sorted and counted by machinery. Records were secured of 49,000 cases; that is, the nationality, age and occupation of 98,000 brides and grooms were taken. The occupations of 98,000 fathers and the nationality of 294,000 individuals are also recorded.

The first separation of the cards was according to nationalities. Three groups were made. All cases where both bride and groom and the parents of both were born in the United States were put in one group and called the American Group. The Foreign Group was composed of the cases where all six persons were born outside the United States. All other cases were put in a group called the Mixed Group.

The material used in this investigation consists of the sworn answers to the questions on the application for a marriage license. All available applications made in Philadelphia from June, 1913 to June, 1916 were used except those of Negroes. Forty-nine thousand cases were collected which were sufficient to furnish two groups, one from each half of the cards, of five thousand American-born couples with all four parents of American birth. Each of these American groups is large enough to be typical of the whole number of American men and women of marriageable age in Philadelphia.

The results of most general interest have been condensed into the three following tables. Table I gives the occupations of the husbands and the wives in the total number of cases secured. Table II gives the occupations of the whole American Group and Table III for the part of the American Group taken from the first half of the cards. This group will be referred to as American Group No. 1. The statistics were refined to eliminate possible nationality factors for which reason the discussion will be confined to the American Group. But the results secured in the foreign and mixed groups are substantially the same, so that the statements made in regard to the American Group would apply also to these groups and perhaps would appear even stronger because of the larger numbers involved.

In the following tables the last column to the right gives the total number of women in each occupation. When read across the row, the tables show the occupations of the husbands. For example, in the first table the occupations of the husbands of the women without occupations may be found by reading across the first row. In the fourth row across the total is 206, which is the number of women employed in the manufacture of provisions. The 9 in the fourth column indicates that 9 of these women married men also in the provisions group. The eighth column shows that 29 of them married men who were artisans.

A comparison of Tables II and III shows that in a great majority of cases the numbers in the complete American Group are double the corresponding numbers of the half-group No. 1. The frequency with which this occurs is an indication of two facts; in the first place, the tables are based upon sufficient numbers to be indicative of the proportion of people in each occupation in Philadelphia; secondly, any group of large size, taken at random, would fall in these same proportions. The American groups, correlated number for corresponding number throughout, give a Pearson coefficient of correlation of .9 plus. The diagonals, which represent the cases where like marries like, have a correlation of .97. This indicates a regular distribution dependent upon occupation. The significance of this high correlation is discussed later.

A study of these tables is helpful in the discussion which follows. In each table the diagonal from upper left to lower right show the numbers of like marrying like. It is apparent that each number on this diagonal represents a considerable proportion of the row and column in which it appears. The theory that occupation has a strong influence upon marriage selection would imply merely a disproportionate amount of marriage within certain allied occupations, an amount much less than has occurred. Moreover, there are sufficient marriages within the single occupational groups to make it noticeable. In many cases the number in the diagonal is the largest number in both row and column. That this should be so even in the small occupations is surprising since the chance expectation is that men in the large occupations will marry proportionately to the number of women in an industry whether the industry is large or small.

Were marriage merely a matter of chance, women in each occupation would marry men in occupations in proportion to the total number of men employed in each. Thus, if half of all

TABLE I. COMPLETE GROUP.

WOMEN MEN	None	Unknown	Agriculture	Provisions	Clothing	Textiles	General Factory	Artisans	Drivers	Railroad and Street R. R.	Telephone and Telegraph	Finance	Retail Trade	Clerks	Clerical	Public Service	Professions	Semi-Pro-fessions	Personal Service	Domestic Service	Managers and Supts.	Unskilled Labor	Firemen and Engineers	Printing	Miscellaneous	Total
None	151	21	452	635	921	459	2893	3313	907	443	75	268	2427	1745	490	441	987	328	501	674	782	4195	479	263	303	24153
Unknown	1	—	....	....	....	....	1	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	4
Agriculture	....	....	2	....	2	....	....	5	....	....	....	....	1	1	....	....	....	1	2	....	3	....	1	....	....	18
Provisions	....	....	1	9	10	4	38	29	16	7	1	....	21	17	3	13	....	5	3	5	1	9	4	6	4	206
Clothing	9	5	58	102	565	115	679	944	205	100	30	24	637	394	118	77	106	88	108	96	131	171	67	113	57	4999
Textiles	1	1	7	11	43	180	299	294	74	21	2	7	62	80	26	21	9	27	7	24	16	142	29	20	19	1422
General Factory	9	2	22	70	205	103	606	603	213	52	19	5	288	167	57	77	26	35	46	61	31	306	46	78	34	3161
Artisans	....	....	1	1	1	2	10	8	2	2	1	1	4	1	2	2	....	....	....	1	....	2	....	2	1	44
Drivers	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	5
Railroad and Street Railway	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Telephone and Telegraph	....	....	4	4	4	1	38	81	31	15	13	1	75	59	27	12	20	4	....	1	12	6	13	9	2	432
Finance	1	....	....	....	....	....	....	1	....	....	....	—	....	....	1	....	....	....	....	....	....	....	....	1	....	4
Retail Trade	1	1	22	33	38	22	162	233	46	58	6	8	384	146	57	43	36	41	18	21	62	19	21	28	15	152
Clerks	3	2	26	18	15	17	150	243	60	32	10	18	265	324	78	34	76	40	8	30	80	14	39	39	21	1642
Clerical	3	3	27	40	30	15	204	335	109	76	18	87	523	422	208	52	187	81	16	30	125	17	70	55	14	2747
Public Service	....	....	....	....	....	....	1	....	1	....	....	....	....	3	1	1	....	....	....	....	....	....	....	....	....	7
Professions	6	....	25	4	8	5	51	79	14	17	5	27	162	118	49	24	265	44	7	10	58	5	36	15	5	1039
Semi-Professions	7	2	26	6	9	5	55	90	29	22	3	6	91	59	20	19	89	97	7	23	43	12	26	8	12	766
Personal Service	1	1	2	7	6	2	27	30	9	6	1	1	29	18	7	6	11	7	11	25	11	14	3	....	2	237
Domestic Service	3	8	74	69	60	27	327	410	195	89	15	2	114	93	12	65	15	16	56	231	27	505	83	23	40	2559
Managers and Superintendents	....	....	1	....	....	....	4	5	2	1	2	....	4	3	3	....	2	....	1	....	5	....	5	1	....	39
Unskilled Labor	5	3	33	57	58	100	781	745	284	76	17	3	187	215	14	89	30	43	27	56	40	756	66	48	25	3758
Firemen and Engineers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	—	....	....	2
Printing	1	....	4	4	8	4	50	55	17	9	1	1	29	26	3	5	5	2	....	8	3	11	7	35	3	291
Miscellaneous	....	....	1	1	6	8	14	16	3	2	....	....	7	10	2	3	1	2	....	4	6	7	47	3	6	149
Total	202	49	789	1071	1989	1069	6390	7520	2219	1029	219	459	5312	3901	1178	985	1865	861	818	1301	1436	6193	1042	747	563	49207

TABLE II. AMERICAN GROUP.

WOMEN MEN	None	Unknown	Agriculture	Provisions	Clothing	Textiles	General Factory	Artisans	Drivers	Railroad and Street R. R.	Telephone and Telegraph	Finance	Retail Trade	Clerks	Clerical	Public Service	Professions	Semi-Professions	Personal Service	Domestic Service	Managers and Supts.	Unskilled Labor	Firemen and Engineers	Printing	Miscellaneous	Total
None	40	3	148	49	31	38	405	556	207	142	25	133	729	583	194	123	417	92	31	60	276	115	136	72	73	4678
Unknown	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Agriculture	....	....	—	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	1	....	....	3
Provisions	....	....	....	5	....	3	9	6	5	3	....	....	5	5	1	4	....	1	....	1	1	2	2	....	1	54
Clothing	2	....	13	9	16	6	113	176	38	27	7	4	95	114	35	25	22	16	5	6	22	15	22	23	16	807
Textiles	....	....	1	3	1	27	52	66	21	8	2	6	5	23	6	10	3	2	1	4	5	8	2	5	8	269
General Factory	1	1	7	6	8	10	125	140	59	16	4	2	47	50	16	22	6	6	....	8	2	19	16	24	12	607
Artisans	....	....	....	1	....	....	4	3	1	1	1	....	2	....	....	1	....	....	....	1	....	....	....	....	....	15
Drivers	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Railroad and Street Railway	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Telephone and Telegraph	....	....	3	....	3	1	10	23	11	7	5	....	24	30	12	7	5	1	....	1	4	2	7	7	....	163
Finance	....	....	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Retail Trade	....	....	12	5	5	1	36	65	16	20	3	6	60	64	17	14	12	12	1	7	7	5	6	8	6	388
Clerks	....	....	11	4	1	3	37	88	19	12	3	7	109	143	39	18	29	12	1	5	35	3	11	9	8	607
Clerical	1	....	10	12	6	3	61	124	29	32	10	13	195	173	72	11	72	33	3	10	61	2	18	15	7	973
Public Service	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	—	....	....	....	....	....	....	....	....	....	2
Professions	....	....	18	2	2	3	27	38	4	10	3	12	71	52	25	12	114	27	4	2	22	2	22	2	5	479
Semi-Professions	1	....	10	....	1	1	17	23	6	8	1	2	21	21	10	5	34	19	1	4	16	1	6	5	7	220
Personal Service	....	....	....	1	....	....	2	5	....	....	1	....	6	4	....	2	6	3	1	....	3	....	....	....	....	34
Domestic Service	1	....	8	9	4	2	26	48	43	11	2	....	24	18	2	11	1	5	2	32	5	28	14	1	5	302
Managers and Superintendents	....	....	....	....	....	....	1	1	....	....	....	....	1	1	2	....	....	....	....	....	3	....	3	1	....	13
Unskilled Labor	....	....	10	9	5	12	151	164	73	22	3	1	43	38	11	29	7	6	3	9	3	82	28	7	5	721
Firemen and Engineers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	—	....	....	1
Printing	....	....	....	1	1	3	12	20	8	1	....	....	7	9	....	....	2	2	....	2	2	3	2	14	1	90
Miscellaneous	....	....	....	....	....	....	1	2	....	....	....	....	1	2	....	1	1	....	....	1	2	1	1	....	2	15
Total	46	4	251	116	84	113	1089	1548	541	321	70	180	1452	1332	442	275	731	237	53	154	469	288	297	193	156	10442

TABLE III. AMERICAN GROUP NO. 1.

WOMEN MEN	None	Unknown	Agriculture	Provisions	Clothing	Textiles	General Factory	Artisans	Drivers	Railroad and Street R. R.	Telephone and Telegraph	Finance	Retail Trade	Clerks	Clerical	Public Service	Professions	Semi-Professions	Personal Service	Domestic Service	Managers and Supts.	Unskilled Labor	Firemen and Engineers	Printing	Miscellaneous	Total
None	27	2	68	22	20	17	209	280	109	75	14	66	359	290	96	60	193	42	14	29	150	49	76	35	27	2329
Unknown	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Agriculture	....	....	—	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	1	....	....	3
Provisions	....	....	....	3	....	1	5	2	4	2	....	....	4	4	....	2	....	....	....	1	....	1	1	....	....	30
Clothing	1	....	5	6	10	2	53	85	16	12	4	3	50	60	21	16	14	8	1	3	13	9	13	15	6	426
Textiles	....	....	1	2	....	7	26	34	11	5	....	1	5	12	5	5	....	....	....	1	3	4	1	2	5	130
General Factory	1	....	4	4	2	6	58	69	24	8	3	1	28	20	11	16	2	2	....	6	1	8	8	8	4	294
Artisans	....	....	....	1	....	....	2	1	....	1	1	....	2	....	....	....	....	....	....	....	....	....	....	....	....	8
Drivers	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Railroad and Street Railway	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Telephone and Telegraph	....	....	2	....	3	1	7	16	8	3	2	....	14	13	7	3	2	1	....	....	....	1	3	1	....	87
Finance	....	....	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Retail Trade	....	....	4	3	1	....	16	28	9	13	....	1	37	35	10	10	6	4	....	1	4	3	4	3	3	195
Clerks	....	....	3	1	....	1	21	45	8	4	....	4	57	80	28	8	16	2	1	5	11	....	6	5	6	312
Clerical	....	....	4	5	2	3	24	55	16	17	6	5	106	96	39	4	37	21	2	2	30	....	8	9	3	494
Public Service	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	—	....	....	....	....	....	....	....	....	....	1
Professions	....	....	12	....	1	1	9	17	2	3	....	8	33	26	17	4	66	10	4	1	18	2	11	1	2	248
Semi-Professions	1	....	4	....	1	1	7	13	3	6	1	....	13	7	7	4	18	6	1	2	8	1	4	....	2	110
Personal Service	....	....	....	....	....	....	1	4	....	....	1	....	2	2	....	2	4	2	1	....	1	....	....	....	....	20
Domestic Service	....	....	6	8	3	2	13	25	21	1	1	....	16	10	2	4	....	1	2	18	2	11	7	1	4	158
Managers and Superintendents	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	....	....	....	....	....	3	....	2	....	....	8
Unskilled Labor	....	....	3	6	2	2	81	84	35	11	2	1	31	23	5	18	4	3	1	6	....	40	10	5	2	375
Firemen and Engineers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	....	....	0
Printing	....	....	....	1	1	....	7	11	1	1	....	....	2	7	....	....	2	2	....	1	2	....	1	9	....	48
Miscellaneous	....	....	....	....	....	....	1	1	....	....	....	....	1	2	....	1	1	....	....	....	2	3	....	....	1	13
Total	30	2	116	62	46	44	541	770	267	162	35	90	761	690	249	157	365	104	27	76	248	132	156	94	65	5289

men were employed in manufactures, it would be found that one half of the manufacturing women, one half of the professional women, one half of the women clerks, etc., would marry men in manufactures.

If a girl enters a profession, there is one probability in four that she will marry a professional man and small likelihood that she will marry into manufacturing. Ability to predict the occupation of the man whom a woman will marry may well be regarded as belonging in the realm of clairvoyance. Yet, while it will always be impossible to prophesy for an individual woman, for a group of women such prediction is not only easy but extremely accurate.

For this work it was necessary to secure a coefficient of propinquity-expectation. This is the ratio between the number of cases that would be predicted by the laws of chance and the number that actually occur.

The following illustration will exemplify the laws of chance. Place in a bag thirty-one balls and thirty-one cubes, each of which is either red, blue or green. Shake the bag and then draw at random the balls and cubes in pairs, one ball and one cube at each draw. If this process is repeated many times, it will be found that of the possible combinations of colors certain ones occur more frequently, depending upon the number of each color. If there are twice as many red balls and red blocks as of any other color, there will be four times as many chances of drawing a red pair as of drawing a pair of any other color.

If however, the red balls and cubes are placed in one part of the bag, the blue balls and cubes in another part of the bag, the green balls and cubes in a third part and the bag shaken very slightly, the chances of drawing two of a color are considerably increased. New tables can be constructed showing the effect of propinquity. The drawing is still made at random, by chance, and yet there is a decided increase of possibility that like will be paired with like.

Were marrying merely a matter of chance, the first illustration would explain the relation of occupation to marriage selection. The balls and cubes represent men and women respectively; the colors symbolize their occupations. The amount of intermarriage would be directly proportional to the numbers employed in each line of work. However, the second illustration typifies the actual influence of occupation. The position of the balls and cubes in the bag corresponds to occupational propinquity in life. Women in the home have no occupational propinquity and they marry entirely by chance as the blocks were drawn in the first illustration. The number of their husbands from any industry is in direct proportion to the number of men employed in that industry. This is shown in the tables. However, they are the only group of women thus subject to chance and the tables show that they are the only group of women who have married husbands in these proportions. One tenth of the total number of men are employed in general factory work. Yet in some cases more, in others less, than one tenth of the women in an occupation marry men in general factory work, the proportions varying according to the particular occupation of the wives.

Questions of method arise, first of determining the expectation of marriage between people of various occupations and second of comparing this expectation with the empirical data. A small table will serve as an illustration. Suppose that there are three possible occupations and that men and women are distributed among these occupations. The table should be read across for women and down the columns for men.

EMPIRICAL TABLE.

	A	B	C	Totals
A............	5	8	7	20
B............	3	3	1	7
C............	1	1	2	4
Totals........	9	12	10	31

There are 9 men and 20 women in the first occupation, 12 men and 7 women in the second and 10 men and 4 women in the third. This would give a total of 31 men and 31 women. A marriage would be possible between any of these men and each of these women; that is, there would be 31 possible marriages for each woman and for each man. Since there are 20 women and 9 men in Group A, there are 9 times 20 or 180 possible combinations between the men and women in Group A. Likewise, the number of possible combinations between the men in Group A and the women in Group B is 9 times 7 or 63 and between men in Group B and women in Group C it is 48. If a table of possible combinations is made, it will be as follows:

	A	B	C	Totals
A............	**180**	240	200	620
B............	63	**84**	70	217
C............	36	48	**40**	124
Totals........	279	372	310	961

There are 961 possible combinations but only 31 marriages are possible. Therefore, if each number of the above table is divided by 31, a table will be formed which will give what could be expected to occur were marriage merely a matter of chance. This Expectation Table will show the distribution of the 31 marriages among the people in the three occupation groups. The distribution of marriages represented in this table corresponds to the distribution of colors when the balls were drawn at random.

EXPECTATION TABLE.

	A	B	C	Totals
A............	**5.8**	7.7	6.4	20
B............	2.0	**2.7**	2.3	7
C............	1.2	1.5	**1.3**	4
Totals........	9	12	10	31

A comparison of the Empirical Table with the Table of Expectation shows where actuality exceeds the expectation and where it is less than expectation. The diagonal contains all cases of like marrying like and indicates that Group A married Group A less than would have been predicted by chance while in the other two cases the reality slightly exceeded expectation.

Dividing each number in the Empirical Table by the corresponding number in the Table of Expectation gives a third

table, of which each number is the ratio between the actuality and the expectation. This may be called the coefficient of expectation or in this case the coefficient of propinquity expectation.

COEFFICIENT TABLE.

	A	B	C
A....................	**.86**	1.04	1.09
B....................	1.50	**1.11**	.43
C....................	.83	.67	**1.54**

The diagonal further indicates that in the first group the number of cases where like married like is less than the expectation. In the second and the third group the index of measurement is more than unity. Where the index exceeds unity, the reality is greater than the expectation. Where the index is less than unity, expectation is greater than reality. The total chances of like marrying like may be determined by dividing the sum of the diagonal of the Empirical Table by the sum of the diagonal of the Expectation Table. In this case like marries like slightly more than the expected number of times.

By the method illustrated the following table of expectation, Table IV, was computed for the American Group. A comparison of this table with Table II shows that each number in the diagonal of the Empirical Table exceeds the corresponding number in the diagonal of the Table of Expectation; that is, like marries like beyond expectation. If marriage were purely a matter of chance as far as occupation is concerned, Table II and Table IV would be very nearly identical. However, there are but few places where they approach identity.

Table V is a detailed comparison in the American Group of the empirical table of marriage, Table II, with the expectation table of pure chance, Table IV. Each number in this table is a coefficient of expectation, that is, it is the ratio between the number of times a marriage occurred and the number of times that it might have been predicted by chance. Numbers greater than unity represent more intensive intermarriage and numbers less than unity represent combinations that occur less frequently than expectation. This table is the main center of interest in the statistical presentation of the material. The

TABLE V. TABLE OF COEFFICIENTS FOR AMERICAN GROUP.

	None	Unknown	Agriculture	Provisions	Clothing	Textiles	General Factory	Artisans	Drivers	Railroad and Street Railway	Telephone and Telegraph	Finance	Retail Trade	Clerks	Clerical	Public Service	Professions	Semi-Professions	Personal Service	Domestic Service	Managers and Superintendents	Unskilled Labor	Firemen and Engineers	Printing	Miscellaneous
None	1.94	1.68	1.32	.943	.824	.751	.830	.802	.854	.987	.797	1.65	1.12	.977	.980	.998	1.27	.866	1.31	.870	1.31	.891	1.02	.833	1.04
Unknown	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Agriculture	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Provisions	....	....	....	8.33	....	5.14	1.60	.749	1.79	1.81	....	....	.666	.726	.437	2.82	....	....	....	....	.412	1.34	1.30	....	....
Clothing	....	....	.670	1.00	3.47	.687	1.34	1.47	.909	1.09	1.29	.288	.847	1.11	1.02	.235	.389	.873	1.22	.504	.607	.674	.959	1.54	1.33
Textiles	....	....	.155	1.00	.463	9.28	1.85	1.65	1.51	.967	1.11	1.29	.134	.670	.527	1.41	.159	.327	.730	1.01	.414	1.08	.261	1.01	1.99
General Factory	....	....	.480	.890	1.64	1.52	3.09	1.56	1.88	.857	.983	.191	.557	.646	.623	1.38	.141	.435	....	.894	.073	1.14	.927	2.14	1.32
Artisans	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Drivers	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
R. R. and St. R. R.	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Telephone and Telegraph	....	....	....	....	....	....	.588	.952	1.30	1.40	4.59	....	1.06	1.44	1.74	1.63	.438	.270	....	.416	.546	.444	1.51	2.32	....
Finance	....	....	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....	....	....	....	....
Retail Trade	....	....	1.29	1.16	1.60	.238	.890	1.13	.796	1.68	1.15	.811	1.33	1.29	1.04	1.37	.442	1.36	.508	1.22	.402	.467	.544	1.12	1.03
Clerks	....	....	.754	.593	.205	.457	.585	.978	.604	.643	.737	.669	1.29	1.85	1.52	1.13	.683	.871	.325	.559	1.28	.179	.637	.802	.882
Clerical	....	....	.428	1.11	.766	.285	.601	.860	.575	1.07	1.53	.775	1.44	1.39	1.75	.429	1.06	1.49	.607	.697	1.40	.075	.651	.834	.481
Public Service	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—	....	....	....	....	....	....	....	....	....
Professions	....	....	1.56	.376	.519	.579	.540	.535	.161	.679	.935	1.45	1.07	.851	1.23	9.52	3.40	2.48	1.65	.283	1.02	.151	1.62	.226	.698
Semi-Professions	....	....	1.89	....	.565	.420	.741	.705	.526	1.18	.680	.528	.686	.748	1.07	.864	2.21	3.81	.893	1.23	1.62	.165	.958	1.23	2.13
Personal Service	....	....	....	....	....	....	.563	.992	....	....	....	....	1.27	.922	....	2.23	2.52	3.89	5.78	....	1.96	....	....	....	....
Domestic Service	....	....	1.10	2.69	1.65	.612	.825	1.07	2.75	1.19	.988	....	.572	.467	.156	1.38	.047	.730	1.31	7.19	.369	3.36	1.63	.179	1.11
Mgrs. and Supts.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5.14	....	8.11	....	....
Unskilled Labor	....	....	.577	1.12	.862	1.54	2.01	1.53	1.95	.993	.621	.080	.429	.413	.360	1.53	.139	.367	.820	.847	.093	4.12	1.37	5.25	.464
Firemen and Engineers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	66.67	....	....	—	....	....
Printing	....	....	....	....	....	3.08	1.28	1.50	1.72	.361	....	....	.560	.784	....	....	.317	.979	....	1.50	.495	1.21	.781	8.48	.746
Miscellaneous	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	—

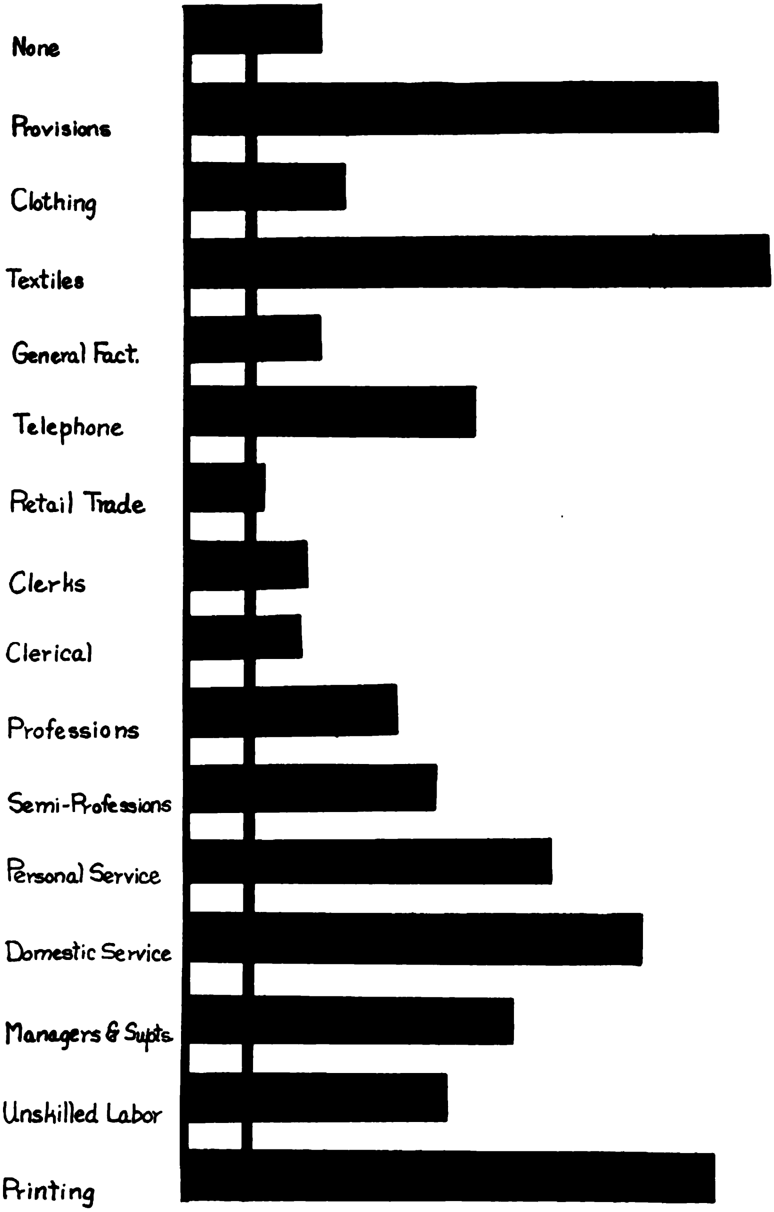
diagonal represents the coefficients of marriage within each occupation. Each number in the diagonal exceeds unity and for most of the occupations the ratio is greater than two. Because of the interest and importance of marriage within the occupation, a graph of this diagonal was made.

This graph represents the ratios of like occupations marrying like. The solid black line represents unity of expectation. The columns represent the ratio of the actuality to this unit of expectation. In all cases where there were sufficient numbers to permit of statistical treatment, the reality exceeds the expectation. In all but the least skilled and most undifferentiated occupations there is at least twice the expectation and many times this is far exceeded.

When the numbers in the diagonal are added, the sum gives the number of cases of like occupations marrying like. When the sum of the diagonal of the Empirical Table is divided by that of the Table of Expectation the quotient is 2.79. For the mixed group it is 2.50 and for the foreign group it falls to 2.00. These are the actual coefficients of propinquity expectation for large groups in Philadelphia and it is very probable that these figures are approximated in most of the industrial cities where similar conditions exist. This means that among Americans of American parentage, 2.79 times as many marriages are occurring within the occupations as would take place were marriage merely a matter of chance. For the mixed group it is 2.5 times as many and for the foreign group twice as many.

The statement has been made that throughout the American Group the coefficient of expectation for like occupation marrying like is 2.75. A comparison with the results of a research made in connection with this throws an interesting light on this coefficient. Using the same cards as the source of material, a study was made of the intermarriage among nationalities. Tables of expectation and of coefficients were made The coefficients for intermarriage of natives of native parentage was found to be 1.8 while that of intra-occupational marriage is 2.75. Irrespective of the occupation, the rate of marriage within it is greater than between sons and daughters of American parents. There is twice as much marriage between

GRAPH.—SHOWING RATIO OF LIKE MARRYING LIKE.



employees of textile mills as between the children of German-born parents. The important deduction is not that there is so little intermarriage within lines of nationality but that there is so much intermarriage within occupations.

Any ambiguity of results given so far is probably due to their applying to intermarriage of groups of people rather than to those within a particular occupation. The fact that there are hundreds of subdivisions of occupation in the textile mills, in the boot and shoe industry, etc., made statistical treatment of particular occupations impossible. Another study was made in order to determine to how great an extent propinquity is a matter of the particular occupation.

A supplementary investigation was made of statistics of Bryn Mawr alumnae. It was found that about 90 per cent. of the married alumnae had married college graduates. More than 60 per cent. of them married men in professions. Out of ten doctors who graduated from Bryn Mawr and later married, seven married doctors. There was a great deal of intermarriage within such groups as school teachers, social workers, doctors and musicians. These figures were obtained through the courtesy of Dean Isabelle Madison from a list of the occupations of over five hundred alumnae and their husbands. This list contained all cases that could be collected.

The statistical results did not differ greatly from those given in this paper. Yet here was a group of women who had been trained along highly specialized lines. Here, if anywhere, would be a chance to work out results significant for their individual and human meaning rather than the statistical. The grouping of occupations in this paper was owing to the necessity for groups large enough to give the results a statistical meaning. The Bryn Mawr study gave an opportunity for interesting individual treatment. Cases of teachers, doctors and others easily classified gave results similar to those obtained in the large groups already discussed, except that there was a greater degree of intra-occupational marriage. Thirty cases of odd or unusual occupations difficult to classify remained.

Of these thirty marriages there were sixteen in which there was no similarity of occupation but the other fourteen married as follows:

Women.	*Men.*
Explorer	Explorer
Lawyer	Lawyer
Farmer	Farmer
Manager of Photo Plays	Manager of Photo Plays
Art Student	Landscape Engineer
Editor	Editor
College Secretary	College Secretary
Newspaper Writer	Reporter
Law-office Secretary	Law Student
Assistant Superintendent of Children's Bureau	Secretary of Children's Bureau
Settlement Worker	M. D. Settlement Worker
Student of Sociology	Student of Sociology
Student of Architecture	Civil Engineer
Student of Biology	Professor of Biology

These cases give strong evidence of the influence of occupational propinquity since it would be impossible for all these unusual marriages to occur merely as a matter of chance.

Suitable statistical evidence as to the sufficiency of the data comes from two mathematical comparisons. The first of these consists of a comparison of the number of individuals in each of the occupations of this complete group with the total number in each occupation in Philadelphia. This is found to be nearly a simple proportion throughout.

The second source of evidence is even more convincing because it concerns only those of marriageable age in Philadelphia. It is a refined grouping. Both of the American groups were selected at random in a statistical manner—by pure chance. Thus, each is a statistically typical group. Yet the number in each occupation in one group correlated with the corresponding number in the other group gave a coefficient of correlation of .9 plus. It is upon such evidence as this that the ratio of the number of men in a particular occupation to the total number of men in the group is considered as a fair index of the theoretical possibility of marriage in each occupation.

The proof as to the constant distribution of data consists of two parts. In the first place, great emphasis has been laid upon the amount of intermarriage within the occupation. This is represented by black-faced diagonals in the tables. The Pearson coefficient of correlation of the diagonals in the two American groups is .97. This indicates that at the time shown there was a constant effect of propinquity throughout the American Group. This high correlation held in the other tables. The second point of interest was whether or not the tables were sufficient to show the general distribution of marriage so that it was fair to predict the chance of marriage on this basis. This would be shown by the correlation, number by number of the two American groups. It is impossible to determine by inspection. However, the Pearson coefficient of correlation for each number of one table correlated with the corresponding number of the other table was worked out and found to be .9 plus.

Study of occupational propinquity upon marriage selection leads to the conclusion that a girl's choice of her vocation has a directing influence in deciding from which occupation she will marry her husband. Tables giving the proportion of fathers and sons and of fathers and daughters in the same occupation were made. They give new results. Computation of the coefficients of expectation shows that the chances are even for a man to marry into his own occupation and for his son to enter the same occupation. The close relationship between the occupations of father and son has long been a well-established fact but woman in industry is so recent a phenomenon that there has been no realization of the close occupational relationship of husband and wife. These tables with other similar data will make possible a new type of statistics. With almost as much certainty as is offered by the Mendelian Law it will be possible to predict what the chances are for a girl entering a particular occupation to have her children enter the same occupation. These results studied with reference to nationality will demonstrate the process of climbing the ladder of industries supposed to be typical of the development of a race. In order to obtain such specific deductions, it is necessary to deal with large numbers but as the movement already involves one half of the marrying women in the industrial cities of the country, it is large enough to merit consideration.

In modern industry where the large numbers of women and the selection of abilities by different occupations exist, *specialization of ability through heredity, environment, and training is favored by the propinquity of like types of men and women in industry.* To whatever extent an industry requires specialized ability, it may be bred by the matings within the industry. As the conditions of an occupation change, a new type of ability will be required and the breeding will mechanically change to the new type. No psychological examination to determine the complex required by the industry is needed for this breeding—survival within the industry is the test. The three biological essentials are present, heredity, training, and environment. Where men and women are employed together in like positions, each profession or specialized occupation is the natural breeding place for people of the type of ability required. This situation must be recognized both by those who believe in heredity and by those who favor environment. Sex propinquity in modern industry seems destined to affect the matings and through the matings the type of the coming generations.

NOMINATIONS FOR OFFICERS OF THE ASSOCIATION 1918–1919.

By virtue of appointment by President Wesley C. Mitchell, and to carry out the provisions of Article 9 of the Constitution of the Association, we submit herewith nominations for officers of the Association for the year 1918–1919 as follows:

President

JOSEPH A. HILL

Vice-Presidents

WILLARD C. BRINTON
CARROLL W. DOTEN
WILFORD I. KING

Counsellors

WESLEY C. MITCHELL
FREDERICK L. HOFFMAN
WALTER F. WILCOX

Treasurer

S. B. PEARMAIN

Secretary

ROBERT E. CHADDOCK

Librarian

HORACE L. WHEELER

Editor

JOHN KOREN

Signed: WILLIAM A. HATHAWAY,
FREDERICK S. CRUM,
ALLYN A. YOUNG,
Nominating Committee.

REVIEWS AND NOTES.

Introduction to Mathematical Statistics. By Carl J. West, Ph.D. Columbus, Ohio: R. G. Adams and Co., 1918. Pp. 144.

This book affords a mixed feeling of delight and disappointment.

According to his preface, the author addresses himself to statisticians who, not being also mathematicians, are unacquainted, or only partly acquainted, with the theory underlying many of the statistical processes used by them, or that might be profitably used if they could do so understandingly. To avoid the limitation that has made the existing treatises on the subject unserviceable to these persons, he aspires to convey the matter in more elementary mathematical media. It is not a handbook on statistics, for it assumes a familiarity with the ordinary statistical methods. Rather, the author seeks, not to "popularize," but to make accessible to larger numbers a knowledge of the science underlying an art that is practiced, in many respects, on the basis merely of authority.

The reviewer's response to the note in this preface was instant and exultant, for he is himself one of the large class addressed. He dares to believe, moreover, that this feeling and his subsequent experience with the book were somewhat representative, and therefore ventures to set down, for the sake of the common good, his impressions after reading it.

We are correctly described by the author as frequently uninformed on the reasons for our statistical conduct. While we earnestly desire to be instructed, we are handicapped by the limits upon our knowledge of higher mathematics. Perhaps the reviewer's maximum attainment, comprising introductory courses through analytical geometry and calculus, is typical. Perhaps, also, his present vacant memory of the content of those courses, long since completed, in an unpracticed subject is even more typical. The available books that we have boldly opened have proven quite beyond us, except at most in spots, and those near the beginning. We are troubled with the fidelity of their authors to the technical terminology and forms of expression of mathematics. We are suffocated with the mathematical atmosphere. We are exhausted by the mathematical gymnastics they put us through. We are utterly baffled by the long leaps from "since so-and-so is true, it is apparent that such-and-such follows," when it is not only not apparent to us, but not at all fathomable even after hours of soundings with our inadequate plumb line. In a word, our minds are non-mathematical. We may even be called boneheads by the plain spoken. What we need is a presentation of the theory of our art in terms boldly defying the standards of good form for mathematical expression, and without mathematical exercises thrown in for our mental discipline. We would rather read ten pages of utterly naive explanation that instantly carries a point to our undeveloped mathematical comprehension than spend ten times as long on one page of scrupulously scientific and coldly dignified stuff that never touches us. Speaking etymologically, we would like a book that will patiently *instruct* us and not aim to *educate* our mathematical abilities or presuppose any mental agility with the concepts and terminology of higher mathematics.

This, then, is the group that the author has essayed to befriend. It is from their point of view, and not that of a mathematician, that this review is written.

The general plan of the book lends itself to an easily comprehended development. The author begins with the familiar graphical device of a wavy line connecting successive points and gives this a simple mathematical expression as a "curve" located with respect to its axes and amply equipped with definitions. He describes the significance of such a curve and of the area within it, and the theoretical meaning of a smoothed curve. From this the nature of the frequency curve is developed in mathematical terms that facilitate later discussion, and its aptitude for interpreting typical, although incomplete, data is explained. A chapter on averages then describes the mean, both arithmetical and geometric, the median and the mode, and explains the peculiar statistical properties and serviceableness of each. Then follows an analysis of the form of a frequency curve as disclosing the nature of any distribution and the dispersion of the data. Measures of dispersion, their mathematical significance and their comparative virtues are explained. A chapter is given to the normal frequency curve, in which the theory of it is stated and applied in fitting such a curve to given data.

Then follow chapters on the correlation of series of data. In these the author's plan of discussion is most successful in its adaptation to the readers whom he addresses. He avoids the too mathematical terminology and concepts employed in the explanations of the theory of correlation commonly found. He builds onto the concepts of the frequency curve, already made familiar, and develops by simple steps the nature of correlation, the evidences of its existence, and the measure of its degree. The subject is given further special treatment in chapters on correlation from ranks and on the method of contingency.

A chapter on the moments of a distribution explains how the equation may be found for a straight line to fit data susceptible of being so interpreted. In an appendix, the fitting of frequency curves to statistical distributions as developed by Pearson is explained and formulas given for those readers who are more adept in mathematics than the class to which the author mainly addresses himself.

The delightful features of the book lie in the simply planned selections of essential topics and in the evident attempt to develop them in language understandable by ordinary statisticians. With perseverance, the reader of the class addressed will be pleased with the grasp he will get of the theory of statistics as presented in this volume.

But this delight, although great, will be marred by disappointments. In the first place, while well planned, the discussion is not well composed. It is often obscurely phrased. The point of departure is in nearly every case that of the mathematician, discursing on abstract mathematical formulae, rather than that of the concrete statistical setting in which the statistician finds his problem. The attention of a non-mathematical statistician would be far more likely secured, his interest better sustained, and his comprehension facilitated and quickened if the chapters began with a concrete statistical problem for which the theory was then developed as the method of solution. Not only are the mathematical topics introduced without previous reference to their statistical bearing, but they are abruptly introduced. There is want of introductory and transitional passages to hook up the matter under discussion with what had preceded, as well as with concrete settings. The effect is to leave the reader with insufficient perception of what it is all about and how it bears on what he already knows of statistical methods.

The author's expression further misses the mark at times in that, notwithstanding the limitations on his selected group of readers, he too often writes as a mathematician, assuming that terms, condensed or elliptical expressions, and suggested explanations that would be quite obvious to mathematicians will be clear to those whom he addresses. While the statisticians addressed may, indeed, worry out the meaning, they will be irritated, if not discouraged, at having to work out puzzles before they can get at the matter that interests them. The whole book extends to only 144 pages of text. It could well afford to have been doubled in volume in order to include fuller definitions and greater statement of detail.

Another source of confusion is a number of inaccuracies. Many of these are plainly typographical, such as inevitably occur in setting up mathematical copy. Some of these are obvious to any reader. For example the omission of the dollar sign from the mean prices found on page 33; the omission of "q" from "frequency," on page 28; and the transposition of the side and top legends in Table IX, page 69. Another less obvious, and hence more perplexing error is found on page 40, where the paragraph at the middle of the page beginning "The median can," etc., and Exercises 19 and 20 apparently should come at the top of the page. These defects will give readers little or no trouble. But thoughtful proofreading ought not to have permitted such perplexing errors as the following: the substitution of the digit 2 for 5 in the footing of the fourth column on page 50, which does not agree with the totals for the same items as shown on pages 24 and 33; the insertion of the subscript 3 with the parenthetical term near the bottom of page 87; the substitution of the figure 6 for the letter y in the expression for S_3, and the ommission of the subscript 1 from the letter y in the expression for S_5, on page 98; the substitution of the exponent 2 for 3 in the term d in the reduction of moments on page 99; the reference to page 91 instead of 96 for formulas used on page 101; the substitution of the subscript y for x with $\bar{y}$ in the equation on page 108.

Of like disconcerting effect is occasional looseness, if not inaccuracy, of expression. On page 48, the paragraph defining the mean squared deviation is headed "The Standard Deviation," while the definition of the standard deviation is given on page 51. In the text on page 49 the Greek letter sigma is designated to represent the mean squared deviation, while in the accompanying equation, and in subsequent usage it is designated by the usual sigma squared. On page 83, the mean squared deviation of the regression means is derived and is then divided, according to the text, by the *standard deviation* of all the corresponding array, but according to the equation, by its *mean squared deviation*. At the bottom of page 112, reference is made to the mean standard deviation of certain quantities when the mean squared deviation is meant.

In working out the computations for the formulas at the bottom of page 106, the reviewer has not been able to derive the same solutions as those shown on page 107.

Another apparent inaccuracy is so consistently followed as to leave the reviewer in doubt whether the author has made a mistake or is himself simply dense. In applying the definition, on page 71, of the respective means of the x- and y- arrays to the problem as described on pages 75 and 76, and tabulated on page 77, it has seemed that the x- array has been confused with the y- array. On page 82 the values shown for the standard deviations of x and y seem to be a transposition of the values required by the definitions near the head of the page. This is essentially the same difficulty as that just noted. It is present also in the interpretation of the example on pages 78 and 79, for the reviewer cannot follow the explanation of the second distribution unless he takes for the y's what seems, by definition to be the x's. The probability is against the author repeatedly making the same mistake. But, then, he is guilty of most indefinitive definitions and non-explanatory explanations for the readers he hopes to assist. The reviewer intends, for his own enlightenment, to submit this to someone more qualified than he to pass upon the mathematics of the case. But he here records, as one of the readers addressed, the results which the book itself has produced on this point.

The effect of the author's, at times too condensed expression, at times obscure phraseology, and of the inaccuracies noted and the appearance, if not the fact, of confusion between general theory and specific application is to cover the trail for the ordinary statistical reader in his pursuit of the point of discussion and to compel him to stop and tread around in a disconcerting, and even discouraging, endeavor to find the trail again. He is little, if at all, interested in the making of trails on his own account in this field of exploration, or in cultivating ability do to so. He would like to make use of the road already opened by the Karl Pearsons, so far as he can learn it. But for that purpose, he wants to have the road shown to him and does not desire to reconstruct it.

By way of summary: This book is far more comprehensible to ordinary statisticians than any mathematical statement of statistical theory that the reviewer has seen. Anyone who has had algebra and who has the general notion of mathematical expression can follow most of the matter in the book if his interest in statistical theory is sufficient to withstand the resistance offered and if he has time enough outside of making his living to "plug" at the subject. What is here said in adverse criticism is not to be taken as damning a book that is, in fact, at the head of the list for the purposes for which intended. It is merely to point out to non-mathematical statisticians that this is not *the* book for which they are waiting.

Indeed, the reviewer is inclined to think that that book cannot be written by a mathematician. His habits of thought and expression are against his success. Even if he could overcome that, his professional pride would stand in his way. That book must translate the mathematics of the subject into non-scientific language carrying over as few original expressions as possible. It will be a work, not of scholarship, but of adaptation of expression based on full knowledge of statistical practice. That would bring little credit to the author as a mathematician, and might well commit him to professionally childish work. That book will have to be written by one of the boneheads themselves who, by dint of perseverance, shall have learned the language of mathematics and then, having no mathematical reputation at stake, can dare to write with complete disregard of the highbrow standards of good form in mathematical discussion. His own full knowledge of statistical processes and his fellow feeling for his confrères will induce him to address them understandingly.

ARTHUR SARGENT FIELD.

Washington, D. C.

The Mathematical Theory of Population, of Its Character and Fluctuations, and of the Factors which Influence Them. Appendix A. Vol. I. Census of the Commonwealth of Australia. By G. H. Knibbs, C.M.G., F.S.S., F.R.A.S., etc., Commonwealth Statistician. Published under instruction from the Minister of State for Home and Territories, Melbourne, 1917. Pp. iv, 466.

The above monumental work represents a veritable milestone in statistical theory, which is emphasized by the fact that it has received almost universal praise from a number of leading statisticians the world over. Mr. Knibbs, the eminent statistician of the Australian Government, is by no means unknown to students of advanced statistical methods. His previous contributions have never been voluminous verbalisms, a very commendable but unfortunately rare occurrence in statistical literature. What they lack in quantity of paper they make up in originality and scholarship. The former small pamphlets from the hands of Mr. Knibbs have always brought to the present reviewer a very refreshing breeze of stimulating thought and a stream of new and original ideas. They have always been admirable in their brevity and lucid expression and stand in a class by themselves as examples of a clear and lucid exposition of thought.

One would therefore naturally expect something really valuable in this new tome of the Australian statistician. But even our fondest expectations were surpassed by the receipt of this massive volume of more than 460 large octavo pages, which for all times will stand as one of the leading works on mathematical statistics of the twentieth century. Not that the volume affords easy reading—on the contrary, I readily confess that I have not as yet mastered several pages of the intricate analysis. But this shows the real character of the volume as something different from a mere text-book and marks it as a true piece of research work, which for many years to come will form a most valuable mine of information for future statisticians to work in. In that respect it is equal to the French classics on the calculus of probability by Laplace and Poisson, the works of Quetelet and the recent researches by Lexis and Bortkiewizc, Bachelier, Pearson, Edgeworth, Thiele, Westergaard, Charlier and Peano.

Knibbs, like his Scandinavian colleagues among the mathematical statisticians, shows a close familiarity with the leading works in various languages on the theory of statistics, the classical as well as the modern literature. While most English, American, French and German works on theoretical statistics have become hopelessly one-sided specimens of a particular school of statistical method, the unbiased and intimate knowledge of our Australian author adds greatly to the breadth and value of his work, at least for those who have a fairly good knowledge of international statistical literature. The footnotes show how busy a reader Mr. Knibbs has been of the foreign statistical literature. To students of small nations like those of the Scandinavian countries this becomes natural, because they must often publish their articles in two and often three journals of different countries of varying language to get a hearing before a larger body of readers than those of their own countries. The English writer on statistics does not encounter this obstacle (if it can be called so), and the knowledge of Mr. Knibbs of foreign writings in at least half a dozen languages is therefore very praiseworthy and probably accounts for his ability to select the most typical and important parts of such foreign writings as well as his own originality of handling his material. Take for instance the third chapter on "Curve Constants and Intermediate Values," and the following chapters on "Special Types of Curves," "Group Values" and "Summation and Integration," where the footnotes indicate that Mr. Knibbs has read nearly all the available mathematical literature and nevertheless been able to present a new and wholly original treatment, which especially becomes very instructive in his generalized flexible probability or frequency curves. Mr. Palin Elderton and Mr. Udny Yule, the well-known English statisticians, in their respective reviews of the present work in the *Journal of Institute of Actuaries* and the *Journal of the Royal Statistical Society* claim that the material has become bewildering in its detail and that our author has somewhat crowded out the methods of Professor Pearson and others in preference to his own. This I consider a picayune criticism and a very narrow-minded attitude. The very recent statistical methods as developed by my own Scandinavian compatriots, Charlier, Wicksell, Akeson and Jõrgensen, and to which I also have contributed in a very modest measure, mainly following in the footsteps of Laplace and Poisson, are not mentioned by Knibbs. This fact should, however, not prevent one from giving unstinted praise to the excellent methods of Mr. Knibbs in deriving the equations of his flexible frequency curves.

In the chapter on nuptiality an equally interesting description of a method of correlation is given in detail with the necessary mathematical formulaes and the protogamic surface.

The chapter on mortality is especially attractive. It is perhaps here more than anywhere else in the book that the author shows how advanced he really is in modern statistical matters. While other authors are content to harp on the old methods of constructing mortality tables along the well-known orthodox lines, Mr. Knibbs investigates the secular changes in mortality by a mathematical process and shows the necessity of constructing what he terms "fluent life tables." In the same connection he discusses also what he calls the "plasticity curve" as well as the composite character of aggregate mortality according to age and according to causes of death. Mr. Knibbs is here touching upon the same ideas which of late years have been taken up by the Scandinavian school of mathematical statistics, although by a different mode of treatment. He divides causes of death as regards *relative* frequency according to age in four typical groups.

In a brief space like this it is of course impossible to do full justice to a work planned on so large and broad a scale. A few selections from the foreword might, however, not be out of place. Mr. Knibbs says here that

"In the realm of official statistics there is an enormous amount of accumulated material, which decade after decade, remains unanalyzed and uninterpreted. This is due to several things, viz., to the fact that routine tabulations largely occupy the energies of the staffs of statistical bureaux, to the fact that much of the mass of material is defective and its correction involves more time than is available, and perhaps still more to the fact that appropriate schemes of mathematical analysis have as yet either not been developed, or are regarded as inapplicable."

In the present monograph Mr. Knibbs has materially advanced our knowledge of such mathematical methods and all earnest students will be thankful to him for it. The Australian Government also deserves high praise for having made possible the publication of this volume. We doubt whether public money has ever been expended in a better undertaking of statistical publications than the present work by the eminent scholar of the young and vigorous nation under the Southern Cross.

ARNE FISHER.

Harald Westergaard: "Statistikens Teori i Grundrids" (Outline of the Theory of Statistics). Second edition, completely rewritten, pp. 430, large octavo. Published through a grant of the University of Copenhagen by the C. E. Gad Publishing Company, Copenhagen, 1916.

This is one of the most important text-books on the theory of statistics that has appeared in recent years, and even a belated review of it may be welcomed by American readers for several reasons. Professor Westergaard is one of the leading statisticians of the world and has produced one of the finest treatises ever written on the theory of statistics. But the prime motive in penning this review is to correct certain erroneous opinions which we believe many English-speaking students are likely to form in regard to the contents of this work. Curiously enough, such opinions about the exact character of Westergaard's book seem to have been caused chiefly by two recent articles from the pen of the same author: "Scope and Methods of Statistics" which appeared in the September number of this QUARTERLY, 1916, and a later one, "On the Future of Statistics," published in the May number, 1918, of the *Journal of the Royal Statistical Society*. These two very able articles leave one perhaps with the feeling that the distinguished Danish scholar is opposed to mathematical methods in statistical analysis, and for this reason they might be used (and in fact they have been used) as a very effective weapon against the small group of students who valiantly struggle—often against great odds—for the treatment of statistical mass data by mathematical formulae. Nothing, however, can be farther from the truth than the assumption that Professor Westergaard views mathematical statistics askance.

Westergaard is unquestionably one of the foremost leaders and advocates of the application of mathematical methods to the field of statistics; and his present work teems with mathematical formulae that require not only a knowledge of elementary algebra but also an extensive study of the differential and integral calculus. Readers who turn to "Statistikens Teori" in the belief that it is an exposition along the well-known lines of the German school of von Mayr and his American followers, like Mayo-Smith and H. Secrist, will therefore be disappointed.

Westergaard calls the theory of mathematical statistics an absolutely necessary "Tjener" (servant) in a number of investigations relating to so widely different subjects as social science, economics, medicine, heredity, biology, psychology, psychophysics, astronomy, physics and chemistry. The enormous development of statistics and statistical methods arises from the fact that the practical application of such methods lay hidden in the mathematical reasoning of a Bernoulli and a Laplace. It thus appears that mathematical statistics instead of being a mere foundling must be regarded as a science of old and renowned ancestry, dating back to a period when statistical data were very scant if at all available.

In a brief and lucid introduction the author characterizes the different statistical problems and then in the next three chapters deals with the history of statistics under these headings: "Statskundskab" (Science of Government), "The Political Arithmetic and Mathematical Theory of Probability," and "Modern Statistics." These three chapters contain a compact and at the same time complete description of the essential development of statistical methods down to the present time. In the fifth chapter the treatment of the collected data and their preliminary classification and analysis are described. This chapter deals with non-mathematical methods along the lines followed in the elementary works of Bowley and the newly issued text-book by Secrist. In the sixth chapter, which is entitled "The Regularity in Games of Chance and Similar Observations," Westergaard leaves the elementary and arithmetical methods behind and plunges into the application of the theory of probabilities.

Chapter VII continues with the development of the exponential curve of the Laplacean-Gaussian Normal Curve of Errors derived from the point binomial by the methods of Laplace and Poisson. Here it becomes absolutely clear that Westergaard by no means ignores the mathematical formulae. Pages 130–162 teem with signs of integration and symbols from higher mathematics. The same exclusive mathematical treatment is continued in the eighth and ninth chapters under the headings, "Application of the Exponential Formula in Anthropometry" and "The Exponential Formula and the Manifestations of Life in Human Society." In these chapters Westergaard points out the necessity of testing whether the formulae from the calculus of probability can be applied directly to the statistical series. In other words, the question is of the stability of the statistical series tested by means of the mathematical theory of probability.

To the present reviewer it seems, however, that Professor Westergaard instead of using the somewhat lengthy tests by means of the normal error curve would have reached his goal quicker by aid of the so-called Lexian-Charlier dispersion theory. When one compares the striking illustrations of this theory in the recent work, "The Mathematical Theory of Probability and Its Application to Frequency Curves and Statistical Methods" (Vol. I, New York, 1916), by Professor Westergaard's colleague and compatriot, Mr. Arne Fisher, the superiority in some respects of the treatment of Mr. Fisher over that of his older and renowned countryman becomes evident. The Charlier coefficient of disturbancy, which is computed without much trouble, affords a very sensitive and powerful criterion for determining the possible presence of disturbing influences in the collected data. Charlier and Fisher have also given a simple mathematical method for eliminating secular perturbations in the collected data. It is to be regretted that these methods are not mentioned in Westergaard's book.

The eleventh chapter contains an excellent representation of interpolation and graduation methods. Those who have read the treatment of the same subject by Bowley will welcome the lucid and striking mathematical demonstration of the various formulae derived from the very general formula of Newton, at the hands of Westergaard.

The chapter on frequency curves shows that the Danish statistician keeps abreast of the modern mathematical development. Here he deals with Pareto's Law, the Curve of Utility, the Makeham Mortality Curves, and the frequency curves in their narrower sense. His treatment is too brief, however, to be of much practical value in actual calculations. Moreover, an error has crept into his demonstration of the computation of the parameters by means of Thiele's half invariants.

Finally, Westergaard discusses the theory of correlation based upon the method of moments and least squares in a most acceptable manner. This part fully exposes the error made by Professor West in the September number of this QUARTERLY, 1916, when he stated that Professor Westergaard apparently was not familiar with the properties of the correlation ratio. The whole trouble with the method of correlation lies at present in the fact that its mathematical theory is as yet unfinished. In this field the modern Scandinavian school of mathematical statisticians, such as C. V. L. Charlier, Sven Wicksell, N. R. Jörgensen and Arne Fisher is at present doing a veritable yeoman's service, and there is no doubt that before long we shall have a sound theory to build upon. The reviewer fully agrees with Westergaard that before this theory is finished much energy will be wasted through the efforts of some American economists in the application of the incomplete theory to economic problems. The mathematicians, however, are not to blame for blunders committed by economists who insist upon using the tools of an unfinished and incomplete mathematical theory to various complicated economic problems. A dull saw does not work very well, especially in knotty pieces of wood.

In others chapters Westergaard treats numerous practical problems from the fields of economics and insurance, such as the theory and use of index numbers, laws of wages, price theories and the theory of risk. Many of these chapters have become small gems of concentration and clear exposition of thought. The Danish statistician has here, on 6 to 7 pages, imparted more real knowledge than some of his American colleagues have spread over more than 80 pages of mere verbalisms.

The reviewer warmly recommends Professor Westergaard's splendid book on mathematical statistics. He is fully convinced, moreover, that the apparent criticisms by Westergaard of the advocates of ultramathematical methods in statistics has reference only to those who—to borrow a phrase from another eminent Danish scholar and statistician, the biologist Johannsen—habitually "treat statistics *as* mathematics and not *with* mathematics." The erroneous view which Westergaard's recent articles may have created in certain American circles arises solely from the fact that what he is apt to regard as elementary statistics are considered as higher mathematics by the majority of his American colleagues, and what he conceives of as higher mathematics is quite beyond the comprehension of most of our present day statisticians.

T. W.

COMMITTEE WORK IN FEDERAL STATISTICS AND LEGISLATION FOR THE FOURTEENTH AND SUBSEQUENT DECENNIAL CENSUSES.

In a paper read at the meeting of this Association at Princeton, N. J., December 29, 1914, Dr. S. N. D. North, Director of the Census from 1903 to 1909, suggested[*] that economists and statisticians take counsel of each other as to what course they could best pursue to promote the interests of governmental statistics, especially in view of the approaching Federal Decennial Census of 1920. Dr. North's paper was a continuation of part of the theme of Professor Willcox's article in the *Political Science Quarterly* for September, 1914. The Executive Board of our Association, acting upon this and other suggestions, appointed a Committee on Federal Statistics to coöperate with a similar committee of the American Economic Association, and empowered that Committee to consider the whole problem of federal statistics in relation to the needs of the American economists and statisticians. The question of the 1920 Census was subordinate, therefore, to the problem of governmental statistics considered in its entirety.

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[*] "The Census Office in Commission." QUARTERLY PUBLICATIONS of the American Statistical Association, Vol. XIV, p.467

Other associations and societies, actuated directly and indirectly by the suggestion of Dr. North, and having more specialized interests, appointed committees to consider the bearing of plans for the 1920 Census upon the subjects of inquiry with which they were concerned. These Associations and Societies were:

American Public Health Association, Section on Vital Statistics: Committee on Relation of 1920 Census to Vital Statistics, W. H. Guilfoy, Chairman; Edwin W. Kopf, Corresponding Secretary (July, 1916);

American Association for Labor Legislation; Committee on 1920 Census, Irving Fisher and John B. Andrews (February, 1917);

Casualty Actuarial and Statistical Society; Committee on Social Statistics and the 1920 Census, I. M. Rubinow, Chairman (April, 1917).

Representatives of the American Economic Association, American Statistical Association and American Public Health Association* met at the City Club, New York City, on January 27, 1917, discussed some of the problems of federal statistics, incidentally the 1920 Census, and adopted the following resolution:

> "That the coöperating committees favor the appointment by the President of a statistical commission to make a survey of federal work in statistics and to make recommendations for the coördination and improvement of such work."

The work of the American Public Health Association Committee has been outlined elsewhere.† The Committee appointed by the Casualty Actuarial and Statistical Society has been prevented from holding any meeting by war exigencies, but has had correspondence with the Director of the Census and with the Chairman of the Committee on Census, House of Representatives, chiefly with respect to Section 8 of the proposed bill. A round-table discussion of 1920 Census problems was conducted under the auspices of the American Statistical Association, December 28, 1917, at the meeting in Philadelphia. Mr. Koren presided. Dr. Joseph A. Hill, Dr. Helen L. Sumner, Dr. F. L. Hoffman, Dr. J. W. Trask and Mr. E. W. Kopf presented the views of federal bureaus and of some American learned societies. A quotation from Professor Allyn A. Young's Presidential address to our Association, December 27, 1917, will also be of interest as bearing on the attitude of American learned societies toward the Census and other federal statistical enterprises.

"A committee of this Association, coöperating with committees of other associations, has been studying the problem of the organization of statistical work in Washington. I am informed that it has given favorable consideration to proposals looking toward the creation of a central statistical commission. It is hoped that its efforts will help to secure tangible progress toward that end. But the functions of such a commission ought to include more than merely introducing some measure of coördination into the work of the existing Washington offices. It should make recommendations to Congress for the inauguration of new statistical activities, utilizing either established offices or new ones according to the circumstances of the particular case."*

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* W. C. Mitchell, W. A. Hathaway, John Koren, W. F. Willcox, T. S. Adams, F. L. Hoffman, E. W. Kopf, N. I. Stone.

† New York Medical Journal, October 6, 1917, and QUARTERLY PUBLICATIONS of the American Statistical Association, September, 1916 and December, 1917.

Meanwhile, the Federal Children's Bureau had presented to the American Association for Labor Legislation, meeting at Columbus, Ohio, December 29, 1916, a statement of its needs for statistics of the American family. That Association adopted a resolution, urging the tabulation of the facts collected upon the schedules of the 1910 Census.† The Children's Bureau could use, and in the opinion of responsible private statisticians should have, also, similar data from the records of the 1920 Census. Section 8 of the Bill as passed by the House, July 3, 1918, does not specifically provide for the enumeration of the facts. (See later comment on Section 8.)

The Director of the Census appointed a committee of experienced bureau officials on July 10, 1917, "to consider what changes in the act of July 2, 1909 . . . would be necessary or desirable in making provision for the next or Fourteenth Census." This committee held nineteen meetings between July 10 and December 4, 1917. The Thirteenth Census act was gone over, section by section, and only such changes were recommended as were, in the opinion of the committee, needed to insure efficiency and economy in the organization of the work of taking the Fourteenth Census. No radical revision of the Thirteenth Census act was deemed necessary. The importance of promptly completing the work of the Fourteenth Census within the limit of time allowed by law, or before July 1, 1922, was constantly kept in mind. To further these main ends, the Bureau Committee made due allowance for increase in the field and office forces, and for such increases in compensation as were believed to be necessary in order to retain or secure the grade of employees required for the work; it also aimed to avoid burdening the schedules with questions of little value, or of value not commensurate with the cost of securing the data. Certain defects in the Thirteenth Census act in connection with the prosecution of frauds were also remedied. The Director of the Census presented this report to the House Committee on the Census on February 20, 1918. The House Committee held numerous meetings between that date and April 10, 1918. The complete text of the bill submitted by Mr. Rogers, together with the discussion by the House Committee, was published, with index, in a document of 260 pages.‡

* QUARTERLY PUBLICATIONS of the American Statistical Association, March, 1918.

† American Labor Legislation Review, March, 1917, p. 187.

‡ "Hearing before the Committee on the Census, House of Representatives, Sixty-fifth Congress, Second Session, on a Bill to Provide for the Fourteenth and Subsequent Decennial Censuses." Government Printing Office, Washington, D. C., 1918.

The bill, amended in a few minor particulars as compared with the Census Bureau Committee draft, was introduced in the House on May 8, 1918, as H. R. 11,984 (*Cong. Rec.*, 65th Cong., 2d Session, p. 6712), and was referred to the Committee on the Census. The House Committee reported the Bill on May 21, 1918, without further amendment, accompanied by report No. 581. A minority report, No. 581 Part 2, was submitted by Mr. Hersey. On June 22 the House, sitting as a Committee of the Whole on the State of the Union, commenced work on the Bill. Mr. Hersey addressed the House on the general scope and objects of the proposed law. He urged that the 1920 Census be limited to an enumeration of the population (as required by Section II of Article I of the Constitution). Furthermore, Mr. Hersey objected in particular to the provision in the reported bill for "fifteen statistical experts at $2,000 each" and to the change in the method of appointing the supervisors of the Census. The bill reported by the House Committee stipulated that these supervisors be appointed "by the Secretary of Commerce upon the recommendation of the Director of the Census." Under former practice, these supervisors were appointed "by the President, by and with the advice and consent of the Senate." This objection brought in another question. The Bureau Committee had recommended, and the House Committee had so reported it, that the date of the Census should be advanced from April 15 to January 1, 1920. The change in the method of appointing the supervisors had been made in the draft submitted by the Bureau Committee, "because the Senate in all probability will not be in session at the time when the appointment of supervisors must be made. The next Census . . . will be taken in January, 1920. The present Congress will expire March 4, 1919 and the next Congress will normally not meet until December of that year. But the supervisors should be selected and commissioned between July 1, the date on which the Bureau is organized on the decennial Census basis and October 1, or ninety days before the date of the Census."* The change in the date of taking the Census (from April 15 to January 1) in Section 20 was made to meet the requirements of the Census of agriculture.†

Mr. Aswell replied to Mr. Hersey (p. 8813 of the *Record*), emphasizing the need (1) for taking the Census as of January 1, 1920; (2) for including a Census of agriculture, manufactures and of mines and quarries; (3) for revising the Thirteenth Census law so as to allow sufficient time for planning the 1920 enumeration, thus to avoid the initial haste and confusion which characterized the Thirteenth Census. After indicating clearly the character and provisions of each section of the Bill, Mr. Aswell considered some broad needs of the Bureau of the Census. His statement of the first need will be of interest to American statisticians who have had the larger problem of governmental statistics in mind.

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* P. 21, Hearing before the Committee on the Census, February 20, 1918.

† Idem p. 28.

> "Permanent recognition by Congress that the Bureau of the Census is the one statistical service of the National Government, created by the Congress for this sole purpose, to which should be assigned all inquiries for statistical facts required by this national body, as well as statistical work which is now being done in many different ways and more or less accurately by boards, commissions and a few other bureaus of departments of the regular service. We should remember that we created this service to do our statistical work and that we have made our annual appropriations to enable this office to thoroughly equip itself with statistically trained employees and all other resources and machinery for prompt, efficient and accurate statistical work. . . . Because of the decentralization of the statistical work of our National Government, no one of us today knows just where to secure the data we need. The evil has been growing for a number of years. The time has come for the National Congress to place itself on record in this matter. We should say to all branches of the national service in this city that the statistical work of our Government must be done by the statistical bureau we created to do this class of work."

The remainder of the debate of June 22 was devoted to further discussion of the advisability of changing the date of the Census, of incorporating a Census of agriculture, manufactures, mines and quarries. Debate on the sections of the bill began June 25, 1918. As finally passed by the House the various important sections are substantially as follows:

Section 1: The Census shall include: population, agriculture, manufactures, and mines and quarries in the United States, including each State, the District of Columbia, Alaska, Hawaii and Porto Rico. A Census of Guam and Samoa shall be taken in the same year by the respective governors of those islands and of the Panama Canal Zone by the governor of the Canal Zone in accordance with plans prescribed and approved by the Director of the Census.

Section 3: In addition to the staff provided by the Legislative, Executive and Judicial appropriation act for the fiscal year immediately preceding the decennial Census period, there may be employed: an Assistant Director, a chief statistician, a disbursing clerk, an appointment clerk, a private secretary to the Director, 4 stenographers, 8 expert chiefs of divisions, and 15 statistical experts. The Assistant Director shall be appointed by the President, by and with the advice and consent of the Senate. The chief statistician, the disbursing clerk, the appointment clerk, the chiefs of divisions, and the private secretary to the Director shall be appointed without examination by the Secretary of Commerce upon the recommendation of the Director of the Census. The statistical experts and the stenographers shall be appointed in conformity with the civil service act and rules.

Section 5: Provides salaries of officials as follows:

Director	$7,000
Assistant Director	4,500
Three chief statisticians and the chief clerk	3,000 each

Two other chief statisticians	3,000 each
Geographer	2,750
Disbursing clerk	3,000
Appointment clerk	2,750
Chiefs of divisions	2,250 each
Private secretary to the Director	2,250
Statistical experts	2,000 each
Stenographers provided for in Section 3	1,800 each

Section 8: The heart of the bill. Stipulates the topics or inquiries to be included in the Census schedules. The population schedule is to include queries for each inhabitant as to: name, place of abode, relationship to head of family, color, sex, age, conjugal condition, place of birth, place of birth of parents, nationality or mother tongue of all persons born in foreign countries and of parents of foreign birth, number of years in United States, citizenship, occupation, whether or not employer or employee, whether or not engaged in agriculture, school attendance, literacy, tenure of home, and the name and address of each blind or deaf and dumb person. The agriculture schedule is to include name, color, sex, and country of birth of occupant of each farm, tenure, acreage of farm, acreage of woodland, value of farm and improvements, the encumbrance thereon, value of farm implements, number of live stock on farms, ranges and elsewhere, and the acreage of crops and the quantities of crops and other farm products for the year ending December 31 next preceding the enumeration. Inquiries to be made also as to the quantity of land reclaimed by irrigation and drainage and the crops produced; also the location and character of irrigation and drainage enterprises and the capital invested in such enterprises. Manufactures, and mines and quarries schedules shall include name and location of each establishment, character of organization, whether individual, corporate or other form, character of business or kind of goods manufactured, amount of capital actually invested, number of proprietors, firm members, copartners and officers, and the amount of their salaries, number of employees and the amount of their wages, quantity and cost of materials used in manufactures, principal miscellaneous expenses, quantity and value of products, time in operation during year, character and quantity of power used, character and number of machines used.

The American Public Health Association Committee addressed a letter to the Director of the Census with respect to the inquiries on the population schedule. The letter asked for an expression of Bureau opinion on the inclusion of the following inquiries on the population schedule, the Committee having borne in mind the need for restricting the scope of the Census:

1. The American Public Health Association Committee had received several requests from its correspondents that it incorporate in its communication to the Director on the legislation for the 1920 Census, the subject of family statistics. Specifically the Committee's letter asked that for each married or widowed person the following facts be enumerated:

(a) Calendar year of marriage (or, number of years married).

(b) Number of children live-born to the marriage.

(c) Number of such live-born children living on Census Day.

The Director replied substantially as follows:

Inquiry regarding the number of children born and the number living on Census Day had been made part of the Eleventh Census (1890) and of the Twelfth Census (1900). No tabulations were made of the 1890 data, and but limited use was made of the 1900 facts (28th volume of the Immigration Commission report). The Thirteenth Census schedules bore the following inquiries in regard to each married, widowed or divorced woman, "number of years of present marriage" and "mother of how many children," the latter question being sub-divided into (1) number born, *i. e.*, the number of children (excluding stillborn) that each such woman had had during her lifetime, by her present or by any former marriage, and (2) the "number of children now living," whether they were residing with her or elsewhere. Various practical difficulties prevented the issue of any tabulations of these subjects of inquiry. Such a tabulation had been tentatively provided for as a part of the Bureau program, but this is now contingent somewhat upon the demands upon the Bureau for war work. "The inclusion in the schedule for 1920 of inquiries similar to those for 1910 also can be decided later, as the form and subdivision of the inquiries to be made on the various Census schedules is determined by the Director of the Census, and the matter will thus receive due consideration at the proper time.[*]

2. Whether person is a survivor of the war with the Central Teutonic Powers. The Director was asked whether it would be advisable to provide for an enumeration of survivors of the present war. The Director's letter in reply suggested that consideration of the possibility of providing for this enumeration be deferred until the period for taking the Census is nearer at hand and the probable status of affairs on Census Day can be more nearly determined.

3. Interdecennial or State Censuses. The Committee suggested that a provision for Federal subsidy of State or Interdecennial Censuses, similar to Section 22 of the Census Act of March 3, 1879, be included in the 1920 Census Bill. The Director's letter said that the Bureau was entirely mindful of the need for a more frequent enumeration of population. It was not thought practicable to attempt to secure authority for an interdecennial Census of population of limited scope even, as a part of the Act providing for the Fourteenth Decennial Census. In the opinion of the Bureau the necessary legislation should not be sought until after the substantial completion of the decennial enumeration of population and the publication of the reports early in 1922 is assured.

Section 9. Provides for appointment of 26 supervisors. See comment in preceding part of this note on objections on the floor of the House to mode of appointing the supervisors. (Pages 9136–9143, *Cong. Record*, 65th Congress 2d Session, give full text of debate on this section.)

[*] See page 7, "Tentative Program of the Bureau of the Census, 1916–1919," Government Printing Office, Washington, D. C., July, 1916.

Section 12. Stipulates how and when the Census shall be taken. Census date for enumeration of population changed from April 15 to January 1. See also Section 20.

Section 23. A new paragraph has been inserted, the purpose of which is to eliminate, as far as possible, the "boosting" tactics employed in many cities and towns during the taking of the last decennial Census.

The bill passed the House July 3, 1918. The matter now rests with the Senate Committee on the Census. A further note will be submitted on the course of the bill in the Senate(

E. W. Kopf.

American Public Health Association Committee on Relation of 1920 Census to Vital Statistics, New York City.

Skandinavisk Aktuarietidsskrift. 1918, No. 1–2. Stockholm.

About the year 1903 there appeared a remarkable little journal, entitled "Aktuaren" (The Actuary), published by Scandinavian actuaries. The number contained a series of brilliant articles, showing how advanced the Scandinavian actuaries were in their profession. However, the promising beginning resulted only in a single number. The political differences between Norway and Sweden which terminated the personal union between the two countries killed the attempt to produce a common organ for the actuaries of three sister nations.

In 1914 the Swedish Actuarial Union launched a new journal, entitled "Svenska Akturarieföreningen Tidsskrift." It is this journal which now has become the common organ under the above name, for all the actuaries and statisticians of the three countries. It would, however, be erroneous to regard it as an exclusive Scandinavian journal. In fact, it is truly cosmopolitan and international in character and scope. The present number contains articles in French, English, Danish and in German, the latter article in German being contributed by the eminent Russian statistician, Bortkiewicz. Other articles in English by the Danish actuary, Dr. Steffensen, and the eminent young Swedish statistician, Dr. Wicksell, show how rapidly the Scandinavians are out-distancing their colleagues in other countries in researches on modern mathematical statistics. There is no doubt that the labors of the ultra mathematical statistical school of Scandinavia, under the able leadership of such eminent scholars as Charlier, Wicksell and Jorgensen, have surpassed even the English biometricians in elegance and general application of their methods. It is, however, doubtful if many of our American statisticians and economists would benefit much by the Scandinavian researches, because such researches require an extensive training in higher mathematical analysis, which, unfortunately, our actuaries and statisticians as a rule do not possess. It is a significant fact that the University of Lund has established a professorship in Mathematical Statistics. While we have had plenty of chairs of statistics in our universities this is probably the first instance of a department that devotes its time exclusively to mathematical statistics. The present occupant of the chair is Dr. Wicksell and we doubt whether the Swedish government could have made a better choice than that in giving the professorship to this brilliant young scholar whose recent researches on the theory of probability rank among the foremost of the present time.

A. F.

Is War Diminishing? By F. A. Woods and A. Baltzley. Boston: Houghton Mifflin Co., 1915.

The present deluge of war books, relating directly to the war or social questions growing out of the war makes it rather difficult to criticize or review incisively any one specific work. It will be interesting to see how many of the present war books will survive when once the minds of men settle down to normal conditions. Evidently the vast majority of the present books on the war will soon be forgotten and only a few will remain. To the present reviewer one of the most interesting war books is a little brochure written by a Chinese scholar. This deep thinker of the Orient points out the futile attempt of many writers to place the blame for the war on certain political parties. The Occidental mind is of a too prospective turn, always looking to the future, and neglects often to compare present conditions with the past. As the Chinese scholar points out, it is of greater importance to compare our own conduct with that of our forefathers than to speculate on what the coming generations will think of us. The white race certainly has no reason to feel superior or proud in comparison with the yellow race when it has reared such a monster as the German Empire. To the Chinese scholar the whole question of the war is that of sex, this term being taken in its most general sense. He divides the peoples into "he" and "she" nations. Germany is an essentially feminine nation according to the opinion of this wise Oriental, who evidently has looked deeper below the surface of the different nations of Europe than any other writer of modern times. England and France, on the other hand, he regards as nations with typically masculine traits.

After reading the very stimulating book by the Chinese scholar, the reviewer began to see in a new light some of the interesting ideas in the book by Dr. Woods. Dr. Woods has not tried to write a brief for any one of the various participants in the present war. He has followed a purely retrospective course and limited his research to the concrete and narrow question: "Is War Diminishing?" This severe limitation of his theme does not allow any room for the vague generalities indulged in by various pacifists and peace advocates. His very pertinent remarks on the utterances of such apparently great authorities as Ex-President Taft, Dr. Butler of Columbia University, Professor Thorndyke and Dr. Mitchell will warm the heart of every true scientist. Unfortunately vague generalities and mere verbalism have too often been indulged in by many of our leading citizens. In the past attractive presentation and cheap oratorical phrases have been preferred by the public to the less ornamental language of the scientist. The white man, and especially the German, has in the past decade indulged in a lot of bombastic generalities, which after all have turned out to be mere bubbles of speech. While our "leading" men of the past have talked volumes about the horrors of war and held up before their audiences the chimera of eternal peace, they have never given deep thought to the experience of the past.

Dr. Woods suggests the measurement of the warlike tendencies of the different nations by the duration of the wars in which they have participated. In this respect he finds that Great Britain must be classed as an essentially warlike nation, because of its almost uninterrupted warfare. However, it must be remembered that the British Empire is founded upon maritime power and most of its wars have been fought chiefly on the sea. Naval actions do not require the large number of armed men involved in military operations on land; hence the drain on England will in all probability be found to have been much smaller than on the other nations. It is, however, almost impossible for any writer to measure the number of men who have been engaged in the past warfare of the different nations. For this reason the actual duration of the different wars must at the present serve only as a rough index of the secular variation of warfare.

In his introduction Dr. Woods touches upon many interesting questions, among other things the much debated subject of eugenics. But he does not adhere to the extravagant views of the ordinary "social uplifter" and disgruntled feminist who apparently sees a monster in every male. He is even of the opinion that war may have a beneficial influence upon a nation if it results in a selection of the best fitted survivors of an originally strong and healthy lot. His remarks that man has not evolved essentially by a raising of the average, but that the rise in intelligence of a very small percentage of all mankind has been the feature in the growth of civilization, are well worth notice. One of the most baneful influences of our modern intellectual life is its mediocrity. The average intellect undoubtedly has been advanced tremendously in most countries, but the age of intellectual geniuses of the type of Leonardo de Vinci, Descartes, Newton and Leibnitz seems to be a thing of the past. A few years ago poor benighted Russia seemed the only place in the white man's world from which occasional flashes of genius broke forth. Dr. Woods seemingly is of the opinion that man has evolved in spite of the fact that he has fought presumably half of the time. If warfare therefore is so deleterious it may be asked, How did man get where he is? Of course, it may be a debatable question if man really has evolved. The reviewer is of the opinion that our present age has retrogressed in intellectual attainments in comparison with Greek antiquity and the Italian renaissance. The white man of the future will, in his opinion, have to relinquish the leadership to the yellow man, who in many respects possesses greater staying power and national stability than the white nations of Europe and America. Eventually this may prove of great benefit to mankind, and it seems to him sheer nonsense to speak of a yellow peril. The Chinese mind is in most respects much more dignified than our European mind, and the philosophy of the East is probably sounder than the often highly speculative systems of the Western world.

At any rate, any possible conquest by the Chinese or Japanese would be preferable to the "Weltmacht" of the German.

While the introductory notes by Dr. Woods are very suggestive and original, the present reviewer cannot bestow the same praise on the part of the work accredited to Mr. Baltzley. The statistical summaries and diagrams prepared from various treatises and text books on history are comparatively crude in their makeup. Nowhere does the reader find even the slightest attempt at a mathematical and quantitative analysis of the data. The chronological tables as prepared by Mr. Baltzley do not represent original research beyond that of a simple tabulation. Probably the author has something better in store for us, but if this be the case, he ought to have indicated it in the text. Mr. Baltzley's comments on Poland are of interest; but the downfall of the Polish power must be sought for in a quite different direction from that of pure military extinction. The writer believes it to be a fact that all of the former great nations of Europe, such as Spain, Portugal, Poland and Turkey began to decline as soon as the Jewish element exceeded a certain percentage of the total population; and history seems to be repeating itself in the case of the rapidly disintegrating Austrian Empire, in which the Jews, by their financial strength and by their proportional strength in population, have exerted a tremendous influence. This is a very interesting phenomenon which Dr. Woods and his collaborator might study with profit.

ARNE FISHER.

REPLY TO DR. DAY'S CRITICISM OF MY ARTICLE ON CORRELATION COEFFICIENTS.

It would be unwise to occupy too much of the valuable space of "The Publications" with a lengthy discussion, but Dr. Day's well-stated criticisms are so broad in scope that they seem to call for a brief reply.

He first dissents from my observation as to the frequency of the misuse of the coefficient by reputable statisticians. I hope that he is right and that the cases of that type coming under my observation are fewer than my memory indicates. The instances in question are not at hand at present, but vivid recollections come to mind in which economists who habitually present statistical studies to the public have used coefficients to prove correlation between the cyclical fluctuations of two variables without getting rid of the trend or the lag. However, the question as to the standing of writers misusing the coefficient does not seem to me to be one of importance. My criticisms were intended entirely for the benefit of those who did not use the coefficient correctly. Experts in correlation would, of course, not need any direction concerning its application or interpretation.

Statistical literature has, however, for example, been too commonly favored with contributions in which a coefficient has been used to bolster up an assumption of correlation between short-time fluctuations when the only reason for the high coefficient was the fact that both variables had similar trends which had not been eliminated. In such instances, of course, the data would give a high positive coefficient whether the correlation between the shorter oscillations was direct, inverse, or entirely nonexistent.

The tendency to assume that the high coefficient shown by two variables with similar steady trends is a proof of correlation between the two is probably the most flagrant misuse of the coefficient. As a matter of fact, Pearson's coefficient is entirely without significance for comparing historical variables unless there are a *considerable number* of corresponding up-and-down swings in the variables. If such corresponding swings occur, the plotted curves usually reveal the fact quite clearly. My own rule is that when the correlation is not entirely evident from the curves, it is unsafe to assume that correlation exists. When an examination of the curves leaves one in doubt, the coefficient, if computed correctly, will normally be very low. If the curves seem distinctly to indicate correlation, it certainly does no harm to clinch the evidence by appealing to a high coefficient to prove how successful one has been in eliminating the extraneous factors. It should, however, always be kept in mind that two trends are likely to be similar because of wholly unrelated causes; that in such instances, Pearson's coefficient will show very high correlation with a low probable error; and that, despite this apparently conclusive mathematical evidence, one is wholly unjustified in assuming any trace of interdependence or inter-relationship between the two variables. Two complex curves may be so similar that, with no other evidence whatever, one may be fully justified in concluding that they prove causal relationship. On the other hand, a large coefficient with a small probable error only establishes a similarity between the dominant tendencies of the two variables and, without exception, requires an examination of the plotted graphs or additional evidence from other sources before any assumption of a causal relationship is justifiable.

Dr. Day next takes exception to my definition of correlation. I still fail to see that I have in any way essentially changed the idea as it has been generally understood by statisticians. I have only sought to make definite and clear-cut a concept which is frequently described in a more or less nebulous and hazy manner. And it still seems to me that "a tendency toward persistent association," as he puts it, between varying phenomena, must be either chance or causal. The former may interest the mathematician—the latter only is of significance to the economist. In my opinion, the latter relationship is the only one in the mind of the economist who refers to correlation. If a given cause always produces a definite effect which proposition Dr. Day does not dispute, then correlation is always perfect no matter how hard it may be to isolate and detect it. The different blind men who described the elephant so diversely did not by their description alter by one iota the characteristics of the elephant.

I cannot agree that the fact that correlation is always perfect, if existent, makes the problem of demonstrating the relationship between two variables necessarily a simple one. Extraneous factors sometimes are hard to eliminate, but only when these are disposed of successfully can the coefficient or any other method really prove correlation to exist. With other factors still present, a high coefficient indicates merely spurious correlation, due probably to the accident of similar trends.

The use of coefficients, therefore, is not in any sense a legitimate substitute for the elimination of the effects of factors other than those which it is desired to compare. If the troublesome interfering causes cannot be scientifically disposed of, to the required degree, then the use of coefficients gives no aid whatever, and we are compelled to concede defeat and pass the problem on to our successors.

I agree fully to "the practical impossibility of isolating economic forces *completely*." Neither are chemical or physical forces ever *completely* isolated. Nevertheless, it must be admitted that physical and chemical laws have been derived and established which are accurate enough to serve the ends in view. Identically similar conditions rule in the economic field except that the difficulties of isolation may, in some instances, be even greater than those besetting the physicist or chemist. I would be the last to assert the present possibility of solving correctly nearly all questions of correlation of economic facts, but fortunately my own experience with scores of typical economic problems demonstrates conclusively that it very often is perfectly feasible to eliminate all undesired influences to the extent necessary to show conclusively whether correlation does or does not exist. The process of segregation having been carried thus far, the facts are so evident that it is wholly immaterial whether they are presented in the form of coefficients or curves. To my mind, the most important single criterion of success for the statistical economist is his ability to isolate to the necessary degree the forces in which he is interested. The method of measuring these relationships is decidedly of secondary importance.

In conclusion, I wish to thank Dr. Day for his courteous comments. I also wish to give assurance that while my criticism concerning the use of the coefficient was not entirely confined to amateurs, I have had no thought of indicting all statisticians indiscriminately. I also concede freely the fact that the correlation coefficient, when intelligently used, is a perfectly satisfactory tool for measuring one's success in segregating a cause and its effect from a mass of confusing data.

WILLFORD I. KING.

NEW SERIES, No. 124. (VOL. XVI.) DECEMBER, 1918.

QUARTERLY PUBLICATIONS OF THE
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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 124. DECEMBER, 1918

OUR STATISTICS OF FOREIGN COMMERCE AND THE WAR.*

BY CHAUNCEY DEPEW SNOW, *Assistant Chief of the Bureau of Foreign and Domestic Commerce.*

It was a high commissioner of the British Government, visiting the States in 1917, who formulated the slogan that has been adopted by the statisticians and others using official trade statistics in war work in Washington. The distinguished foreign visitor had noted with deep interest the numerous somewhat contradictory announcements on the billboards, in the street cars, and in other advertising media to the effect that "ships will win the war," "food will win the war," "fuel will win the war," etc. His comment was that England had made the really vital discovery that statistics will win the war.

Just as it is a good thing that everybody in the Food Administration and people generally should appreciate the importance of food in winning the war, so is it of great moment that the statisticians should be intensely conscious, even excessively conscious, of the importance of statistics in winning the war. The statisticians in the statistical branches of war research in Washington were soon telling each other that "statistics will win the war." This idea permeated the ranks of all the economists and others in Washington using statistics, and was accepted by the compilers and clerks. The trained statisticians were not sufficient in number to do all the statistical work that was required in this process of winning the war by means of statistics. The universities were combed, and the leading business concerns were made subject to the draft for men to do statistical work. Economists and business executives were soon in the ranks in Washington doing statistical work. They soon adopted this slogan and in taking up any phase of their new line of work made it a point to start out with the statement that "statistics will win the war."

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*Paper read at the Annual Meeting at Richmond, 1918.

The catch phrase, which must be admitted as decidedly apt, does not particularly need apologists. Our war-time shipping program has come more and more to rest on a solid basis of tonnage statistics. Our export embargoes and even more our import embargoes have in part been based on calculation of tonnage that may be saved and diverted to more urgent traffic. We were slow in coming to the realization of the extent to which our shipping needs demanded that we change our organized industrial life—that we even give up entirely some customary raw materials for available or partly available substitute domestic raw materials. It was hard for our traders who had had their business connections exclusively with Java and India and other remote points to realize that they must henceforth draw their supplies of materials from Brazil or the West Indies, or other nearby points. It was something revolutionary in business. But it would save tonnage, and tonnage was necessary. and it was done; and put to it, the industries affected have found substitute commodities or substitute sources of supply and have managed to get along. Detailed statistical studies were the basis of this revolutionary change.

Similarly, if we had had detailed statistics of our inland commerce, we should not have felt the full severity of the shortage of freight cars at certain points and the congestion and subsequent embargoes. If we had known exactly the fuel requirements of New England and other great industrial, non-coal producing regions, the hardships of the winter of 1917–1918 could have been avoided. It is only very recently that the Department of Commerce, by statistical studies, has made known to the nation the tremendous increase in carrying efficiency that can be accomplished by a comparatively slight outlay on the Delaware and Chesapeake Canal, the Raritan Canal, and the Cape Cod Canal. It seems almost incredible, yet it is undoubted that at an expenditure on the Delaware and Chesapeake Canal of something like $12,000,000 for work in a very favorable terrain with practically no obstacles, the distance from Baltimore north and from Baltimore to Europe for heavy ocean traffic can be shortened 184 miles.

These are things which we now appreciate and the nation owes a debt of gratitude to these able statisticians and economists and business men who have driven these things home and put through, without hesitation, a program that has enabled us to take advantage of things which we ought to have known before but did not. "Statistics will win the war" is truly not hard to justify.

Trade statistics of the United States are in the main represented by the monthly publication, *Monthly Summary of Foreign Commerce,* and the annual publication, *Commerce and Navigation of the United States.* Our statistical classification of imports, probably more because of tradition than necessity or legal requirement, has pretty closely followed the United States customs tariff. The statistical classification of exports has been a growth of many years, on a somewhat anomalous basis of grouping and alphabetical arrangement. The statistical schedules have been further refined from year to year. There is a constant demand on the part of commercial interests, for refinement of classifications, so that the number and scope of the "All other, not specially provided for" classifications will be cut down. There has been no change in the system of statistical classification; change has been only in this matter of detail, with a tendency toward more specialization.

Next year before this association I expect the story can be told how the export and import classifications have been given a thorough overhauling, arranged on a scientific group basis, with more emphasis on quantity figures, and harmonized somewhat with other statistical classifications. There will also undoubtedly be a story to tell about the change from fiscal year to calendar year, and the change to a country grouping which is more in keeping with the known facts and accepted standards of commercial geography. Within the Bureau of Foreign and Domestic Commerce we have broken ground for all these changes, with the stimulus and very able assistance of some of the country's leading statisticians and commercial geographers, doing war work on the staffs of the Shipping Board, War Trade Board, and War Industries Board.

Our export and import statistics, probably more than any other official statistics collected by the United States Government, are, even in normal times, in demand for government uses. They are for the guidance of Congress in preparing fiscal legislation and legislation bearing on international commercial relations. They are for the use of the Treasury Department and the Department of Commerce in carrying out their administrative functions in connection with the administration of the customs tariff, the navigation laws, etc. They are for the guidance of the Department of State and the Department of Commerce in working out international commercial programs. They are essential to the United States Tariff Commission. The Department of Agriculture and the Department of the Interior use them in determining the direction and effect of the promotive work entrusted to these departments in connection with the development of the natural resources of the United States. And of course, in war time the foreign trade statistics are an indispensable basis for the determination of policies and effects of the administration of the various war-time activities entrusted to such organizations as the War Trade Board, United States Shipping Board, the War Industries Board, the Food Administration, and the Fuel Administration.

There are two other classes of persons who are interested in the official trade statistics of our exports, imports, and tonnage: the business men, and the academic economists, statisticians and writers. The business man who uses the trade statistics is apt to go on the basis that the government collects trade statistics primarily for his benefit. The economists and statisticians are apt to assume that the government collects trade statistics in order to make possible the careful analysis of the progress of the country, to enable the student today to reconstruct the past or the student tomorrow to reconstruct the period in which we now live. Some overlook the fact that the government started collecting statistics of exports, imports and tonnage primarily for fiscal reasons, for the guidance of Congress and the administrative branches of the government and that to this day that is probably the most important end which the statistics have served.

Trade statistics with us from the beginning have been on a utilitarian basis. In Germany where there has been more of the cult of statistics for the sake of statistics and statistics for the statisticians, this utilitarian standpoint has been somewhat obscured. During the war the printed discussions of some of the leading statisticians of Germany have opened up the old German moot questions of statistics to enable the historian, economist, and sociologist of a hundred years hence to reconstruct a precise picture of the furious age in which we are living. In the United States the statistics have been put to greatly increased use during the war, but with more workaday promptings.

In recent years in the United States our official trade statistics have come more and more to be used by our business men as a basis for their operations. I was told recently by an international operator in one of our most important bulk imports of raw materials, that his business month for month for a period of years has been based on the statistics published by our Department of Commerce, and that he has attributed his financial success to his statistical familiarity with the state of his market. The largest manufacturer of an important line of metal goods in the United States, who has for years carried on a nation-wide business, recently told me that his sales program and his advertising appropriations are blocked out unit for unit on the basis of the population statistics issued by our Bureau of the Census. He has recently gone extensively into the export trade, and has been making an effort to arrange his sales campaigns in foreign markets on a statistical basis—very hard to do, but possible. Today the American manufacturer and merchant makes his plans more and more in the light of trade statistics. In the Bureau of Foreign and Domestic Commerce in Washington there is an opportunity to watch this development and to see the increasing use of the trade statistics for dollars and cents purposes. This is true of the trade statistics of foreign countries as well as of trade statistics of the United

States. The whole movement in this direction has been quickened by indispensable wartime reference to trade statistics.

The *Monthly Summary* and the annual volume of *Commerce and Navigation*, supplemented since 1913 by the handy little manuals on "Trade of the United States with the World," taking up exports and imports, by countries, article by article, have well served the main demand for statistical information from the three groups that have been mentioned. The detailed statistics in *Commerce and Navigation*, and the *Trade of the United States with the World*, have been of chief use to Congress and the government offices. The *Monthly Summary* and *Trade of the United States with the World* have served the chief needs of the business men. The economists, statisticians and writers have of course required all the published statistics. The Chief of the Bureau of Foreign and Domestic Commerce makes annually a brief text review of the figures; the war brought out the need of further analysis, and the Department will henceforth publish more analytical comment.

In addition to the published statistics the Department of Commerce has at all times had to meet a demand for special compilations. The Ways and Means Committee of Congress has possibly been the best customer and the most severe taskmaster of the Department in this regard. The committee makes constant use of the official trade statistics, and requires detailed statistical analyses and combinations that could not be anticipated or provided for by general publication. These compilations have to be made specially, and the Department of Commerce has to meet this demand. Similarly the published statistics do not serve all the purposes required by the business men, and special compilation is required to serve business needs. The Bureau of Foreign and Domestic Commerce does such special compilation with reference to a number of the exports and imports of principal importance in American business. In addition many of the trade associations and trade papers have assigned special representatives who make these specialized compilations from the material available in the Bureau. The new problems of war trade and after-war trade have increased the demand for special compilations.

At the outbreak of the world war when we were cut off from trade with Germany we were probably more inconvenienced by the threatened lack of dyestuffs and chemicals than by any other one thing. The dyestuff industry of the United States was on a small scale. We had to have dyestuffs, and there was an opportunity for creating an American dyestuffs industry. The published statistics of the United States did not furnish any clue as to the quantities of individual dyestuffs required for the American market. There was nothing to guide the old and prospective dyestuff manufacturers as to the dyestuffs that were needed here. The nature of the individual dyestuffs was concealed by "All other, not specially provided for" clauses. Estimates, even by the men most intimately associated with the trade, were widely at variance.

The question arose how a statistical basis for the establishment of an American dyestuff industry could be reached. It was decided that the only way was to dig out the invoices of every shipment that had come into the United States in the year 1913, as a pre-war year, and copy the facts off the consular invoices. This was actually done—regarded then as a staggering job. The work was under the supervision of an eminent chemist and statistician who had a technical familiarity with the subject, and personal familiarity with the German dyestuff industry, and recognized standing as a writer on the subject. This statistical census of dyestuff imports has been an important factor in the establishment of the American dyestuff industry, which is already of such proportions as to amaze any one familiar with its status before the war.

The success of the dyestuff census brought a demand for the continuation of the study to all other chemicals. In order that our Department of Agriculture and Geological Survey and our chemical manufacturers and producers in this country may know what the American market requires, the Bureau of Foreign and Domestic Commerce has had a staff, at times as many as thirty employees, tabulating the statistical data in the greatest possible detail from 1913 invoices of imports of all kinds of chemicals other than dyestuffs. This was a task for a chemist as well as a statistician, and although the results have not yet been published the work has proceeded on sound statistical lines as well as on a sound technical foundation. This is commercial statistical work of a practical nature for the national benefit of industry, which I doubt if any foreign country has ever equalled.

When the United States entered the war a heavy demand for statistical information was made on the Bureau of Foreign and Domestic Commerce, and that demand on the whole has increased rather than diminished. The main call for information has been from the government offices. Trade statistics became of moment to the War Department and the Navy Department. They were the backbone of the work of the War Trade Board, the Shipping Board, and most essential for the work of the Food Administration, the War Industries Board, the Fuel Administration, and other government offices. It became necessary to analyse trade channels, trade regions, the tonnage movements between the United States and foreign countries, the trade in individual commodities, and the trade of individual ports, and the trade as a seasonal phenomenon. It became necessary to go back over the trade for a number of years, to make compilations by months, by ports, by countries, and by commodities, that had never been made before. It became necessary to have current reports on the trade at shorter intervals than the customary period of one month, and to speed up the transmission of returns from all the customhouses, speed up the work of compilation, and speed up the final transmission of the statistical data to the war boards in Washington. The Bureau of Foreign and Domestic Commerce and the Treasury officials for a time wrestled with these problems without new means of carrying them to perfection. Some of the war-time organizations were being delayed and interfered with in their work, although I believe practically every one who had the opportunity for calm judgment as to the way the Treasury and Commerce Departments were proceeding with their available resources gave them credit for what they were accomplishing.

It was in midwinter, 1917–1918, when the true realization of the importance of a statistical basis for the export and import embargoes and tonnage conservation was first arrived at.

It was at that time that the difficulties under the old normal scheme of getting statistical returns came to a head. There were committee meetings in Washington at which the war boards told what their needs were. The Treasury Department and the Department of Commerce were freely criticised. Some of the enthusiastic statisticians in the war boards were for taking over *in toto* the work of compiling the trade statistics, and making it a war matter. These statisticians were overlooking the legal basis and *raison d'être* for the publication of the statistics—were overlooking the demands of Congress, the demands of the business men, and the most intimate connection of the trade statistical work, as an integral part, with the whole mechanism of trade information of the Department of Commerce.

Cooler judgment finally prevailed in the meetings of the committees, the requirements of the war boards were definitely formulated, and the Treasury Department and the Department of Commerce pledged themselves to do everything possible to meet these demands. The war boards coöperated in a request to the President for an emergency appropriation for additional clerical and other assistance and the work was soon under way. The chief demand of the war boards was that they should receive statistical returns of trade for ten-day periods, instead of periods of one month. The returns have been made on that basis, I think to the satisfaction of the Shipping Board and the War Trade Board and the Food Administration, the offices chiefly concerned. These various boards of course required their own statistical divisions to work up the basic materials into the combinations which were required for their special purposes. The War Trade Board got together a very large statistical organization for tabulating export license returns and making the comparison between license returns and export figures. The ten-day reports placed a strain on the customs service, and credit is due to the customs organization for the untiring efforts and intelligent direction of machine tabulation and other helps to rapid compliance with the requests of the war boards. The ten-day reports have been kept confidential and no publicity is given to the returns on that short-time basis.

I have referred to the intimate connection of the official trade statistics with the trade information work of the Bureau of Foreign and Domestic Commerce. The effects of war restrictions have brought about an unprecedented interest in foreign trade statistics on the part of our manufacturers. The demands for statistical information have been steadily increasing. As an import embargo has been placed on a certain commodity, or as ship space to a certain foreign market has become progressively restricted, the manufacturers have been forced to take an interest in possible substitute materials and possible substitute markets. The Bureau of Foreign and Domestic Commerce is called on to advise the manufacturers on all these points, and the Bureau is also required to supply in this connection foreign trade information with reference to foreign countries that is sent in by commercial attachés, trade commissioners and special agents of the Department of Commerce, and consular officers.

There is another side to this question in addition to the export and import and tonnage statistics officially collected by the United States Government. The Bureau of Foreign and Domestic Commerce is probably the leading center in this country for statistical information, general economic information, and market reports, with reference to foreign countries. In 1909 the Bureau for the first and last time issued a statistical abstract for foreign countries. Since that year the Bureau has not had appropriations which would enable the continuance of that publication, but has none the less continued to do what work has been done by our government on the official statistics of trade of foreign countries. In addition to the statistics of imports and exports which are required by law at our customhouses in this country, we receive official reports of the values of merchandise for which consular invoices are executed by our consuls in foreign countries. These reports are published in *Commerce Reports* and in the special *Supplements to Commerce Reports,* and have always been of interest to close students of statistics of trade with particular sections of foreign countries. Although the Bureau of Foreign and Domestic Commerce has not been able to continue the statistical abstract of foreign countries it has continued a section on the statistics of the principal countries in the Statistical Abstract of the United States. That section, though very brief, has become a well-recognized source of ready reference material on the commercial and financial statistics of other countries. The official statistics of all foreign countries and colonies are currently received in the Bureau of Foreign and Domestic Commerce and are in constant use there.

Again, compilation in Washington of these statistics of foreign countries has been largely of an utilitarian nature. American manufacturers have wanted to know where given foreign countries purchased their supplies or disposed of their manufactured products, and have called on the Bureau for special statement work of this nature involving compilation from the statistics of foreign countries. The reports of the United States consuls, of commercial attaches, special agents, and trade commissioners on foreign countries have been amplified by a statistical analysis of the foreign markets which they cover. During the war, when minute surveys of the trade of foreign countries have been necessary, this class of work has been done on a larger scale than before.

The special statement work on foreign statistics of necessity had to be limited, as does the special statement work on statistics of the United States, and so far as compilations for commercial organization are concerned, the Bureau has coöperated by making the statistical publications available and supervising the work of outside compilers. Congress and most of the executive departments in Washington have for years looked to the Bureau of Foreign and Domestic Commerce as the center for statistical information on commercial matters of all kinds relating to foreign countries, as well as to the United States. There has been this demand for statistical analysis of certain questions to meet the wishes of the Ways and Means Committee and the other important committees of Congress having to do with commercial questions. Here again there was an unprecedented demand brought on by the war. The War Department and the Navy Department have been deeply interested in the statistics of sources of supply of raw materials of war importance, and facts concerning the market conditions, accessibility, etc. With reference to all foreign countries such information was available in the Bureau of Foreign and Domestic Commerce and demands have been made on the Department to work up the material for the purposes indicated. The staff of the Bureau was not sufficient to meet the increased demands by the war-time organizations, by Congress, and by the business men, so there has been further increase of staff.

The Latin-American Division of the Bureau of Foreign and Domestic Commerce probably has more information with reference to commercial matters in Latin-America than any other one office in the world. This information has been of untold value to the various war organizations. The Bureau has made statistical studies of the foreign trade of Germany and Austria-Hungary, country by country, and article by article. The Bureau has published statistics of the commerce of Germany and Russia, in connection with a study of the commercial treaty status of the two countries which have proved most illuminating. The Bureau has recently published statistics with reference to the sources of supply and consumption of the principal industrial raw materials and foodstuffs, in connection with a summary report on tendencies in economic reconstruction. Statistical studies of the trade of the principal countries of the world by countries and articles are now under way in the Bureau, and will unquestionably prove of value in forthcoming studies of international relations, as well as providing an index for American manufacturers in sizing up foreign markets for their goods and foreign sources of supply for their raw material. These statistics of foreign countries are chiefly being utilized for these basic purposes, although certain specific trade studies,—such as the study of the exports of cotton goods from every producing country and the imports of cotton goods in every consuming country,—are being made. If it is important that Congress and our treaty makers should know the courses of trade, it is none the less important that our merchants and manufacturers should have the information available.

There is one other aspect of the statistical work of the Bureau of Foreign and Domestic Commerce which has only incidentally been touched—I refer to the Statistical Abstract of the United States. The Statistical Abstract of the United States is in the main made up of statistics of trade and industry. The biggest single contribution to the subject matter is the statistics of imports and exports of the United States and the carrying trade of the United States. There is a good deal of other statistical matter included bearing on commerce which is kept currently up to date in the Bureau of Foreign and Domestic Commerce although original compilation is done by trade organizations, or commercial companies, trade papers, or other unofficial sources. The statistical record of progress of the United States from 1800 to date published in the *Statistical Abstract* is kept up currently by the Bureau of Foreign and Domestic Commerce. To meet wartime requests this section and the foreign-country tables have been brought up to the latest date possible and issued separately. Probably the *Statistical Abstract* more than any other one publication has made the Bureau known as a central information office on all phases of commercial and industrial statistics. The *Abstract* answers a multitude of inquiries, and relieves the other government offices of a considerable volume of correspondence. Of course the Bureau of Foreign and Domestic Commerce makes no effort to answer inquiries that should properly be handled by the Bureau of the Census or the Postmaster-General, or the Bureau of Mines, and the other government offices. The *Statistical Abstract* does contain much of the trade information which has been required by the war-time organizations and business men since the outbreak of the war, but with the exception of the information with reference to the effects and results of the first selective draft, the *Abstract* itself shows little change as a result of the war.

I am not a technical statistician, and am not primarily interested in the theory of statistics or in the highly technical aspects of methods of statistical presentation. As a trade investigator and writer on commercial subjects and as a minor official of the federal government I have used trade statistics many years. Recently I have had administrative oversight of the work of compilation of the trade statistics of the United States. The whole work of the Bureau of Foreign and Domestic Commerce is built up around the statistical work. It is my opinion, based on my experience in that work, that the Bureau of Foreign and Domestic Commerce would lose vastly in its efficiency if it did not handle the actual compilation of the trade statistics of the United States. The conclusions reached by some of the committees of administrative officers and statisticians have been that this subject of trade statistics of the United States is simply one phase of trade information and that it should be regarded as such and entrusted to the office which is given by law the position of central information office for trade information, that is the Bureau of Foreign and Domestic Commerce. So long as our statistics are to be regarded from a practical standpoint, I feel that there is the best of reason for having actual compilation done by the offices that are primarily concerned with the subject matter. As the Bureau of Mines and the Geological Survey and the Department of Agriculture would suffer in efficiency by the transfer of their statistical work away from them to a central bureau of statistics, so would the Bureau of Foreign and Domestic Commerce suffer from the transfer of the trade statistics to any such central bureau. The question of a central bureau of statistics has been urged time and again, and was brought up in Washington acutely in connection with the war demands. Since September 1 of this year there has existed a Central Bureau of Planning and Statistics, but, I think fortunately, that Bureau has been organized with the recognition of the value of compilation in the offices primarily concerned with the subject matter, and has acted simply as a clearing house for information and means of eliminating duplication.

The war has placed a very severe test on the efficiency of our official mechanism of tabulating and compiling statistics, both of the United States and of foreign countries. We have had a great amount of ground to cover, and undoubtedly we have not covered it so well as it would have been possible to cover it, with unlimited funds and resources and perfected organization. To meet the strain of war requirements radical changes have been necessary; many of the formerly accepted traditions of official trade statistics have been abandoned; the impetus and enthusiasm, the war needs, and the greatly increased use of official statistics by statisticians, economists, government officials, and business men, have all contributed to progress in methods, and improvement in performance which would have been slow in forcing their way through if the old routine had not been upset by war. On the whole, however, I feel that there is no need for apology on the part of any of the government offices concerned.

EFFECT OF GROUPING IN GRADUATION BY OSCULATORY INTERPOLATION.

By Percy C. H. Papps.

The problem of ascertaining the rate of mortality amongst the general population is quite different from that of ascertaining the rate amongst a selected body of lives. In ascertaining the rate of mortality amongst the members of an insurance company, fraternal society, etc., it is possible to ascertain the number exposed to the risk of death at each age and the resulting deaths. Where it is desired to ascertain the rates of mortality at different ages amongst the population in the registration states, for example, it is necessary to compare as closely as possible the numbers living at each age with the resulting deaths, as in the case of a selected body of lives; but this can only be done by taking the population as shown by the census returns, made once in ten years, and comparing the numbers living at each age with the deaths at each age, as ascertained from the records of deaths, which are preferably taken from the records for a few years before and after the census.

To overcome the irregularities resulting from the data not being sufficiently extensive to give average results and to overcome errors arising in the collection and compilation of the data, graduation is necessary. In computing the rate of mortality amongst a select body of lives, an ungraduated life table may first be compiled from the ungraduated rates of mortality, and a graduated table obtained therefrom. In handling population statistics it is usual to graduate both the population and the deaths, and then to derive what is a graduated rate by dividing the graduated deaths by the graduated population statistics. It must be remembered that in handling population statistics much more extensive errors in the collection of the data have to be handled than where the rates of mortality are to be determined from the record of an insurance company or a fraternal society.

In the June 1910 Quarterly Publications of the American Statistical Association, pages 86 to 109, will be found an account of the graduation of the data derived from the twelfth census of the registration states by Professor Glover. The graduation is made by Osculatory Interpolation and the table on page 100 shows that the well recognized errors due to the tendency to overstate the population at the quinquennial ages ending in 0 and 5 are distributed in each case over the succeeding four ages. For example, the sums of the graduated and ungraduated population for ages 35 to 39 inclusive are identical so that the overstatement of the population at age 35 is spread over ages 36 to 39.

It is proposed to write the graduated values in terms of the ungraduated values for the formula actually used as well as for four similar formulae derived from grouping ages ending in 1 to 5, 2 to 6, 3 to 7 and 4 to 8.

The graduation is made by first summing the numbers in the column showing the population from the bottom up, and then operating on this summation column which gives the population at each age and all higher ages. The deaths were graduated in a similar manner.

Now, let u_x, u_{x+1}, u_{x+2}, etc., be terms of the original series,

$$U_x = \Sigma_x^\omega u_x$$

$$\Delta U_x = U_{x+5} - U_x$$

and

$$\delta U_x = U_{x+1} - U_x = -u_x$$

Then, writing the leading quinquennial differences of U_x in terms of the original series, the results shown in the following table are arrived at, where the coefficients are shown in the columns and the expressions to which they apply in the headings of the columns.

TABLE A.

	$\Sigma_{x+20}^{x+24} u_x$	$\Sigma_{x+15}^{x+19} u_x$	$\Sigma_{x+10}^{x+14} u_x$	$\Sigma_{x+5}^{x+9} u_x$	$\Sigma_x^{x+4} u_x$
ΔU_x					−1
$\Delta^2 U_x$				−1	+1
$\Delta^3 U_x$			−1	+2	−1
$\Delta^4 U_x$		−1	+3	−3	+1
$\Delta^5 U_x$	−1	+4	−6	+4	−1

On page 93 Professor Glover gives a table showing the coefficients of the expressions for the subdivided differences in terms of the differences for intervals of five ages. The table in terms of the present notation is as follows:

TABLE B.

	ΔU_{x-10}	$\Delta^2 U_{x-10}$	$\Delta^3 U_{x-10}$	$\Delta^4 U_{x-10}$	$\Delta^5 U_{x-10}$
δU_x	+.2	+.32	+.088	−.0176	+.0016
$\delta^2 U_x$		+.04	+.048	+.0016	+.0048
$\delta^3 U_x$			+.008	+.0064	−.0048
$\delta^4 U_x$				+.0016	−.0032
$\delta^5 U_x$					+.0080

By means of Tables A and B the leading yearly differences of U_x may be computed in terms of the original series. The results are shown in Table C.

TABLE C.

	$\Sigma_{x+10}^{x+14} u_x$	$\Sigma_{x+5}^{x+9} u_x$	$\Sigma_{x}^{x+4} u_x$	$\Sigma_{x-5}^{x-1} u_x$	$\Sigma_{x-10}^{x-6} u_x$
δU_x	−.0016	+.0240	−.1504	−.0843	+.0128
$\delta^2 U_x$	−.0048	+.0176	−.0720	+.0704	−.0112
$\delta^3 U_x$	+.0048	−.0256	+.0400	−.0224	+.0032
$\delta^4 U_x$	+.0032	−.0144	+.0240	−.0176	+.0048
$\delta^5 U_x$	−.0080	+.0320	−.0480	+.0320	−.0080

The first line in Table C gives one formula for ascertaining a graduated value of u_x, for $u_x = -\delta U_x$ and by writing δU_{x+1}, δU_{x+2}, etc., in terms of the differences shown in Table C, four other formulae may be found. By the usual formula the values in Table D are found.

TABLE D.

	δU_x	$\delta^2 U_x$	$\delta^3 U_x$	$\delta^4 U_x$	$\delta^5 U_x$
δU_x	+1				
δU_{x+1}	+1	+1			
δU_{x+2}	+1	+2	+1		
δU_{x+3}	+1	+3	+3	+1	
δU_{x+4}	+1	+4	+6	+4	+1

By means of Tables C and D the following formulae are obtained, the one first derived in Table C being repeated.

TABLE E.

	$\Sigma_{x+10}^{x+14} u_x$	$\Sigma_{x+5}^{x+9} u_x$	$\Sigma_{x}^{x+4} u_x$	$\Sigma_{x-5}^{x-1} u_x$	$\Sigma_{x-10}^{x-6} u_x$
δU_x	−.0016	+.0240	−.1504	−.0848	+.0128
δU_{x+1}	−.0064	+.0416	−.2224	−.0144	+.0016
δU_{x+2}	−.0064	+.0336	−.2544	+.0336	−.0064
δU_{x+3}	+.0016	−.0144	−.2224	+.0416	−.0064
δU_{x+4}	+.0128	−.0848	−.1504	+.0240	−.0016

It will be noticed that the first and last and second and fourth formulae in Table E have similar coefficients but in reverse order. The coefficients in the third formula are symmetrical.

Now, any value such as δU_y may be derived as shown in the following table:

TABLE F.

δU_y Derived from	Age Groupings						
δU_y	y	to	$y+4$,	$y+5$	to	$y+9$	etc.
$\delta U_{\overline{y-1}+1}$	$y-1$	"	$y+3$,	$y+4$	"	$y+8$	"
$\delta U_{\overline{y-2}+2}$	$y-2$	"	$y+2$,	$y+3$	"	$y+7$	"
$\delta U_{\overline{y-3}+3}$	$y-3$	"	$y+1$,	$y+2$	"	$y+6$	"
$\delta U_{\overline{y-4}+4}$	$y-4$	"	y,	$y+1$	"	$y+5$	"

It is interesting to notice that if one fifth of the sum of the five formulae shown in Table E be taken, we obtain the twenty-nine term Osculatory Interpolation formula given by Mr. George King on page 559 of Volume 41 of the Journal of the Institute of Actuaries. The method of arriving at this formula is shown in the following table, and the table gives a ready comparison of the different formulae in terms of the original series. In this table the different formulae run vertically instead of horizontally as in the previous tables.

TABLE G.

	δU_y	$\delta U_{\overline{y-1}+1}$	$\delta U_{\overline{y-2}+2}$	$\delta U_{\overline{y-3}+3}$	$\delta U_{\overline{y-4}+4}$	Total	1/5 Total
u_{x-14}					−.0016	−.0016	−.00032
u_{x-13}				−.0064	−.0016	−.0080	−.00160
u_{x-12}			−.0064	−.0064	−.0016	−.0144	−.00288
u_{x-11}		+.0016	−.0064	−.0064	−.0016	−.0128	−.00256
u_{x-10}	+.0128	+.0016	−.0064	−.0064	−.0016	0	0
u_{x-9}	+.0128	+.0016	−.0064	−.0064	+.0240	+.0256	+.00512
u_{x-8}	+.0128	+.0016	−.0064	+.0416	+.0240	+.0736	+.01472
u_{x-7}	+.0128	+.0016	+.0336	+.0416	+.0240	+.1136	+.02272
u_{x-6}	+.0128	−.0144	+.0336	+.0416	+.0240	+.0976	+.01952
u_{x-5}	−.0848	−.0144	+.0336	+.0416	+.0240	0	0
u_{x-4}	−.0848	−.0144	+.0336	+.0416	−.1504	−.1744	−.03488
u_{x-3}	−.0848	−.0144	+.0336	−.2224	−.1504	−.4384	−.08768
u_{x-2}	−.0848	−.0144	−.2544	−.2224	−.1504	−.7264	−.14528
u_{x-1}	−.0848	−.2224	−.2544	−.2224	−.1504	−.9344	−.18688
u_x	−.1504	−.2224	−.2544	−.2224	−.1504	−1.0000	−.20000
u_{x+1}	−.1504	−.2224	−.2544	−.2224	−.0848	−.9344	−.18688
u_{x+2}	−.1504	−.2224	−.2544	−.0144	−.0848	−.7264	−.14528
u_{x+3}	−.1504	−.2224	+.0336	−.0144	−.0848	−.4384	−.08768
u_{x+4}	−.1504	+.0416	+.0336	−.0144	−.0848	−.1744	−.03488
u_{x+5}	+.0240	+.0416	+.0336	−.0144	−.0848	0	0
u_{x+6}	+.0240	+.0416	+.0336	−.0144	+.0128	+.0976	+.01952
u_{x+7}	+.0240	+.0416	+.0336	+.0016	+.0128	+.1136	+.02272
u_{x+8}	+.0240	+.0416	−.0064	+.0016	+.0128	+.0736	+.01472
u_{x+9}	+.0240	−.0064	−.0064	+.0016	+.0128	+.0256	+.00512
u_{x+10}	−.0016	−.0064	−.0064	+.0016	+.0128	0	0
u_{x+11}	−.0016	−.0064	−.0064	+.0016		−.0128	−.00256
u_{x+12}	−.0016	−.0064	−.0064			−.0144	−.00288
u_{x+13}	−.0016	−.0064				−.0080	−.00160
u_{x+14}	−.0016					−.0016	−.00032

It will be noticed that the formulae in Table G give the values of δU_y or $-u_y$, so that to obtain the values of u_y or u_x the signs must be changed.

The first five formulae in Table G may be more readily applied if the column of U_x be first computed and the five formulae written in terms of U_x instead of u_x. In Table H the formulae are written in terms of U_x and the signs are changed so that u_x instead of $-u_x$ is obtained directly from the formulae.

TABLE H.

	δU_y	$\delta U_{\overline{y-1}+1}$	$\delta U_{\overline{y-2}+2}$	$\delta U_{\overline{y-3}+3}$	$\delta U_{\overline{y-4}+4}$
U_{x-14}					+.0016
U_{x-13}				+.0064	
U_{x-12}			+.0064		
U_{x-11}		−.0016			
U_{x-10}	−.0128				
U_{x-9}					−.0256
U_{x-8}				−.0480	
U_{x-7}			−.0400		
U_{x-6}		+.0160			
U_{x-5}	+.0976				
U_{x-4}					+.1744
U_{x-3}				+.2640	
U_{x-2}			+.2880		
U_{x-1}		+.2080			
U_x	+.0656				
U_{x+1}					−.0656
U_{x+2}				−.2080	
U_{x+3}			−.2880		
U_{x+4}		−.2640			
U_{x+5}	−.1744				
U_{x+6}					−.0976
U_{x+7}				−.0160	
U_{x+8}			+.0400		
U_{x+9}		+.0480			
U_{x+10}	+.0256				
U_{x+11}					+.0128
U_{x+12}				+.0016	
U_{x+13}			−.0064		
U_{x+14}		−.0064			
U_{x+15}	−.0016				

For the population the T_x column corresponds with the U_x of the above table. By setting the values of T_x on the multiplying machine and multiplying by the coefficients shown in Table H, without clearing the product holes, the graduated value of u_x, in this case L_x, are obtained directly; care being taken to see that the machine is set for multiplication when the coefficient is positive and for division when the coefficient is negative. If one of these short formulae is to be used, the graduated values can be more directly and rapidly obtained in this manner than by building up the differences and subdivided differences shown by Professor Glover.

In the following tables are shown graduated values of L_x, d_x and q_x according to the five formulae. The average of these values is shown which corresponds to the values that might be obtained directly by Mr. King's twenty-nine term Osculatory Interpolation formula, which may be applied by the summation method. The values are shown for ages 30 to 40 inclusive. Tables I, J and K give the values of L_x, d_x and q_x; the latter derived from the formula used by Professor Glover, namely

$$q_x = \frac{d_x}{L_x + \frac{1}{2}d_x}$$

TABLE I—VALUES OF L_x.

x	x to $x+4$ $x+5$ " $x+9$	$x-1$ to $x+3$ $x+4$ " $x+8$	$x-2$ to $x+2$ $x+3$ " $x+7$	$x-3$ to $x+1$ $x+2$ " $x+6$	$x-4$ to x $x+1$ " $x+5$	Average Values
30	*173,618*	172,937	177,940	176,353	177,033	175,576
31	169,201	*169,372*	168,500	173,088	171,805	170,393
32	166,978	160,405	*165,600*	165,228	167,208	165,084
33	161,093	161,563	154,471	*162,809*	162,653	160,518
34	159,571	154,160	157,264	153,401	*160,559*	156,991
35	*157,926*	156,121	149,430	154,912	155,210	154,720
36	156,259	*155,128*	152,851	148,350	153,658	153,249
37	152,032	157,691	*151,846*	149,880	149,366	152,163
38	149,889	150,573	156,234	*147,839*	146,987	150,304
39	144,042	150,934	147,535	150,025	*143,313*	147,170
40	*138,832*	141,327	148,912	141,978	140,883	142,386

TABLE J—VALUES OF d_x.

x	x to $x+4$ $x+5$ " $x+9$	$x-1$ to $x+3$ $x+4$ " $x+8$	$x-2$ to $x+2$ $x+3$ " $x+7$	$x-3$ to $x+1$ $x+2$ " $x+6$	$x-4$ to x $x+1$ " $x+5$	Average Values
30	*1,445*	1,452	1,483	1,453	1,487	1,464
31	1,468	*1,436*	1,448	1,479	1,473	1,461
32	1,488	1,441	*1,437*	1,461	1,471	1,460
33	1,459	1,499	1,434	*1,455*	1,484	1,466
34	1,501	1,440	1,510	1,461	*1,484*	1,479
35	*1,509*	1,517	1,440	1,520	1,508	1,499
36	1,549	*1,534*	1,527	1,470	1,529	1,522
37	1,538	1,595	*1,548*	1,532	1,516	1,546
38	1,559	1,546	1,614	*1,546*	1,531	1,559
39	1,531	1,609	1,546	1,591	*1,533*	1,562
40	*1,522*	1,538	1,626	1,533	1,543	1,552

TABLE K—VALUES OF q_x.

x	x to $x+4$ $x+5$ " $x+9$	$x-1$ to $x+3$ $x+4$ " $x+8$	$x-2$ to $x+2$ $x+3$ " $x+7$	$x-3$ to $x+1$ $x+2$ " $x+6$	$x-4$ to x $x+1$ " $x+5$	Average Values
30	*.008288*	.008361	.008300	.008205	.008364	.008304
31	.008639	*.008443*	.008557	.008508	.008537	.008538
32	.008872	.008943	*.008640*	.008803	.008759	.008805
33	.009016	.009235	.009240	*.008897*	.009082	.009091
34	.009362	.009298	.009556	.009479	*.009200*	.009377
35	*.009510*	.009670	.009590	.009764	.009669	.009642
36	.009864	*.009840*	.009940	.009860	.009901	.009882
37	.010065	.010064	*.010143*	.010170	.010098	.010109
38	.010347	.010215	.010278	*.010403*	.010362	.010319
39	.010573	.010604	.010424	.010549	*.010640*	.010558
40	*.010903*	.010824	.010860	.010739	.010893	.010841

It will be noticed that Professor Glover used all five of the separate formulae, the figures corresponding to those derived by him being printed in italics in Tables I, J and K. In a few places slight differences may be noted between the figures given above and Professor Glover's figures. These are probably due to dropping decimals in the method used by Professor Glover in obtaining his figures.

The values in Table K may be rearranged so that the values derived from grouping ages 30–34, 35–39, etc., are in one column and other groupings in the other columns. By this table a comparison of the application of the method used by Professor Glover to the different age groupings can be made more readily. It may be well to bear in mind that no matter what grouping is used, the totals of the graduated and ungraduated values will agree within the five age groups. The values of q_x are rearranged in Table L.

TABLE L—VALUES OF q_x.

x	0–4 5–9	1–5 6–0	2–6 7–1	3–7 8–2	4–8 9–3	Average Values
30	.008288	.008364	.008205	.008300	.008361	.008304
31	.008443	.008639	.008537	.008508	.008557	.008538
32	.008640	.008943	.008872	.008759	.008803	.008805
33	.008897	.009240	.009235	.009016	.009082	.009091
34	.009200	.009479	.009556	.009298	.009362	.009377
35	.009510	.009669	.009764	.009590	.009670	.009642
36	.009840	.009864	.009901	.009860	.009940	.009882
37	.010143	.010064	.010065	.010098	.010170	.010109
38	.010403	.010278	.010215	.010347	.010362	.010319
39	.010640	.010549	.010424	.010604	.010573	.010558
40	.010903	.010893	.010739	.010860	.010824	.010841

As a test of the smoothness of the graduated values, the third differences are shown in Table M, but carried to one more decimal place than in Table X of Professor Glover's article.

TABLE M—VALUES OF $10^6\Delta^3 q_x$.

x	0–4 5–9	1–5 6–0	2–6 7–1	3–7 8–2	4–8 9–3	Average Values
30	+18	−36	+25	−37	−17	−14
31	−14	−51	−70	+19	−32	−19
32	−39	+ 9	−71	−15	+27	−21
33	+13	+54	+42	−32	−66	− 4
34	−47	0	+98	−10	− 2	+12
35	−16	+ 9	−41	+43	+ 2	− 4
36	+20	+43	+73	− 3	+57	+46
37	+49	+16	+47	− 9	+21	+15
Totals*	216	218	467	168	224	135

* Irrespective of sign.

As might be expected, the sum of the third differences irrespective of sign is smallest for the powerful twenty-nine term Osculatory Interpolation formula, but of the five short formulae the smallest sum is for the grouping where the quinquennial ages ending in 0 and 5 are the center of the groups. With a sufficient amount of data to allow full play for the operation of the law of averages, we would expect very little unevenness in the values of q_x between ages 30 and 40, were it not for the misstatement of ages. The tendency to give an age ending in 0 or 5 is very strongly shown in the data to be graduated, and it seems not unreasonable to suppose that the graduation which will most satisfactorily remove this error will be the one showing the smoothest graduated values; provided, however, that the graduation formula does not remove any characteristics of the data, not due to error, which should be retained. So far as the limited test shows, the grouping of the ages with those ending in 0 and 5 as the center of the groups would seem to be more satisfactory than the groupings used by Professor Glover. In the first case the errors are spread over the younger as well as the older ages, while Professor Glover's grouping throws the errors entirely over the older ages of each quinquennial group.

In Table N are shown one million times the differences between the values of q_x by the twenty-nine term formula and by the shorter formulae. The positive and negative differences are added and the net differences and total differences irrespective of sign are shown at the foot of the table.

TABLE N.

ONE MILLION TIMES DIFFERENCES IN VALUES OF q_x BY TWENTY-NINE TERM AND SHORTER FORMULAE.

x	0–4 5–9	1–5 6–0	2–6 7–1	3–7 8–2	4–8 9–3
30	− 16	+ 60	− 99	− 4	+57
31	− 95	+101	− 1	−30	+19
32	−165	+138	+ 67	−46	− 2
33	−194	+149	+144	−75	− 9
34	−177	+102	+179	−79	−15
35	−132	+ 27	+122	−52	+28
36	− 42	− 18	+ 19	−22	+58
37	+ 34	− 45	− 44	−11	+61
38	+ 84	− 41	−104	+28	+43
39	+ 82	− 9	−134	+46	+15
40	+ 62	+ 52	−102	+19	−17
Positive	262	629	531	93	281
Negative	821	113	484	319	43
Net	−559	+516	+ 47	−226	+238
Total*	1083	742	1015	412	324

* Irrespective of sign.

Table N shows that the grouping used by Professor Glover produces values further from those given by the twenty-nine term formula than any of the other groupings, whether measured by the net difference of the eleven values or by the sum of the differences irrespective of sign. While the grouping 2 to 6, 7 to 1 gives the closest agreement in the aggregate, the individual differences are large. The next in order is the grouping having central ages ending in 0 or 5, and in this case the differences are not large. The grouping 4 to 8, 9 to 3 gives nearly as good results according to Table N, but Table M shows that the graduated values of q_x do not run as smoothly as with groupings 8 to 2, 3 to 7, where the central ages end in 0 or 5.

In conclusion it may be said that in using Professor Glover's plan of graduation the groupings to be used should be carefully considered. It is recognised that the foregoing study takes into account only eleven ages, but they are important ages and were chosen for the reason that marked changes in the progression of the rate of mortality are not looked for between ages 30 and 40. This paper is submitted with the thought that the points herein raised, if of value, may be borne in mind when the time comes to graduate the next Census Table.

A GENEALOGICAL STUDY OF POPULATION.

BY CARL E. JONES.

The study of the many phases of the population problem has been a product in large part of the nineteenth and twentieth centuries, the period which has seen the rise and development of so many of the various fields of knowledge and of investigation closely related to the welfare and interests of mankind. Attention was prominently called to the subject at a time when the writings of the English Classical School of Political Economy were coming into the foreground. The doctrines of the decreasing returns upon land, of the increasing pressure of population upon the material means of subsistence resulted in a certain pessimism in the popular thought of that day which was well expressed in the name, "The Dismal Science," given to Political Economy.

The great interest in the topics of a biological nature which arose one or two generations later has done much to modify the positions held by the earlier writers and to strengthen the basis upon which further work might be done. Still more recently various aspects of the problem have been dealt with by biologists, sociologists, and economists, and the results of their respective findings hold much of promise for the future.

The mode of approach in the study of population problems has resembled that used in other branches of the social sciences in that it has gradually shifted from the philosophical and speculative to the mathematical and explanatory. Malthus in his "An Essay on the Principle of Population" (11) and Spencer in part six of his "Principles of Biology" (15), give classic illustrations of the manner of attack which was employed by the first students of the problem. Crum (2) (3), Duncan (4), Hill (7), Lewis (9), and Mayo-Smith (12), have been more recent students of the problem who have employed statistical data as the main tool in their treatment of such factors as natality, fecundity, marriage ages, and duration of life.

The sources of statistical information regarding population in the United States most largely utilized hitherto, have been the national and state census figures. At the present time no other source is so copious and trustworthy but they do not afford an adequate basis for comparison of the present with other periods only slightly remote. Hence recourse must be had to whatever subsidiary material may be available for the purposes of comparing the population figures of the past one, two, or three centuries with those of the more immediate present.

For the purposes of comparisons for various periods of time, family genealogies furnish one of the most fertile fields of investigation. Since many American genealogies embrace the early settlers from whom many trace one line of their descent; a goodly number of them afford comparable data for two hundred to two hundred and fifty years. Ample time is thus afforded for the rise and fall and the cyclical development of such phenomena as fecundity and longevity to declare themselves.

The work of supplementing the results of national and state censuses by the data obtainable from genealogies is at present in its infancy. Bell has furnished some of the best results yet attained in this field. His recent publication, "The Duration of Life and Conditions Associated with Longevity—A Study of the Hyde Genealogy" (1) has given direct statistical proof for or against positions which formerly were dogmatically maintained, such as the inheritance of longevity, and the correlation between longevity and fertility. Sage has a recent work entitled "A Statistical Study of the Genealogical Records of New England" (14). One hundred genealogical lines, each covering the period 1620–1850, were studied. The data collected included dates of birth, deaths, and marriages of parents; details of second and third marriages; number and sex of children, dates and order of their birth, and dates of their death. Since the study traced the families only through the tail-male lines instead of through the whole family fraternity no basis was afforded for ascertaining the figures for important allied phenomena such as the inheritance of fecundity, the intervals between births, and the comparison of the fertility of the first-born children with the corresponding natality of the total population.

The aim of the present study is to obtain definite statistical data upon certain population characteristics; namely those relating to second, third, and fourth marriages; longevity; the correlation between longevity and fertility; the age at marriage; the correlation between marriage age and fertility; the fertility of parents by periods; the ratio of the sexes at birth; the intervals between births; twinning; and the fertility of first-born children. Each of these factors has been dealt with in turn and tables for each made which present the actual results obtained.

In explaining the method employed in attaining the completed tables, the sources or materials used will be described first and the process whereby the finished tabular results were obtained will then be outlined. Five genealogies were employed and complete indexing for each population trait studied was made of each individual within the family fraternities thus chosen. Each genealogy furnished approximately 4,000 individuals, and the five together furnished a total of 20,412 individuals. Incomplete returns for many individuals within each of the genealogies reduced the number of individuals used as a basis for each of the tables and hence in no case was a number as large as 20,000 obtained in the final tables.

The first step actually taken in the work was to obtain the figures for each one of the thousands of individuals for every one of the population traits to be treated. This process necessitated giving the most careful attention to each one of the household families listed in the several genealogies, since these were the units which afforded the bulk of the information regarding all of the topics under consideration.

The 20,412 individuals were distributed throughout approximately 4,000 such household families, each of the genealogies holding about 800 of this total figure. The compilation was next undertaken in order to get the mass of figures into significant totals and averages; and finally formal tabulation was necessary to present the material in clear and summary fashion. In the presentation of the results the findings for the five genealogies were lumped in the majority of cases since no significant differences were to be found in them. In such cases as twinning, however, where there were important differences, the material was tabulated by the genealogies as well as by the total figures.

In the 20,412 individuals listed were comprised all those persons born in the five genealogies and also the husbands and wives who married into these families throughout all of the successive generations. Approximately 16,412 individuals were born in the main lines of descent, while the remaining 4,000 married into the families. Ten successive generations contained all of the individuals within each one of the five genealogies. The distribution of the 20,412 persons among the ten generations may be approximately stated as follows: 12, 35, 65, 200, 600, 1,700, 4,800, 7,000, 5,000, and 1,000. The fall in the numbers of the ninth and tenth generations was due to the fact that the reproducing potentialities of the eighth and ninth generations had not yet had time to reach their maximum. What would otherwise have been a uniform rise in the distribution was thus vitiated by this condition, though some weight must be given to an undoubted decline in racial fertility.

In presenting the tabular results obtained, the subject of remarriage is the first to receive treatment. In the table which follows the years from 1651 to 1900 are divided into five fifty-year periods, in order to afford a basis for comparison of periods of equal length. The numbers of husbands having second, third, or fourth wives and the number of wives who remarried, who were born within each one of these fifty-year periods respectively, are tabulated.

TABLE I. REMARRIAGES.

Period	Second Marriages	
	Husbands	Wives
1651–1700	8	4
1701–1750	42	10
1751–1800	63	23
1801–1850	108	29
1851–1900	25	21
Total	246	87

Inspection of the figures discloses the fact that nearly three times as many men as women remarried. If third, fourth, and fifth marriages are taken into account, the 246 men who remarried had a total of 272 extra wives and the 87 women who remarried had a total of 94 extra husbands. A ratio of nearly three to one is maintained with these figures also. The figures for the last period are incomplete since so many of the individuals born within the latter portion of it did not have time to attain a marriageable age at all and hence could afford no data for remarriages.

There are very few other treatises of a similar nature with which to compare these figures. Bell does not attack the problem in "The Duration of Life and the Conditions Associated with Longevity." Sage, in "A Statistical Study of the Genealogical Records of New England," found a relatively large proportion of second and third marriages prior to 1850.

The genealogies show that the cause of the remarriages has altered somewhat. Before 1840 the cases were nearly all due to premature death upon the part of either the husband or the wife, generally the latter, and the subsequent remarriage of the one remaining. Beginning about 1840 the genealogies show that divorce assumes an ever-increasing part as a condition associated with second and third marriages. This increase in divorce beginning in 1840, as shown by the genealogies, is in full harmony with the findings of those who have made careful studies of the problem, for instance Lichtenberger, in "Divorce: A Study in Social Causation" (10).

The data for the longevity or duration of life will next be given and by fifty-year periods. No figures will be given for the period 1851–1900, however, since the only individuals born in this period who had died previous to the writing of the genealogies were those dying at comparatively youthful ages. Accordingly the data will be restricted to the four fifty-year periods from 1651–1850. The results are tabulated here according to sex; according to the number of individuals in each chronological group; and the average age-lengths for each of these groups is shown. The incompleteness of these genealogies is well illustrated by the small number of persons, 2,765, out of some 13,000 to 14,000 who had died, for whom the actual length of life could be ascertained.

TABLE II. DURATION OF LIFE.

Period	Males		Females	
	Number	Average Age	Number	Average Age
1651–1700	60	44.1	56	46.8
1701–1750	188	53.9	189	51.4
1751–1800	428	49.2	427	47.5
1801–1850	709	35.8	708	35.7
Total	1,385	42.8	1,380	41.9

Table II shows a shorter longevity for both males and females for the last period than for any of the preceding, but this is probably due to the fact that the last period contained a much higher percentage of those dying in infancy. As between the sexes, each of the fifty-year periods, with the exception of the first, which includes only a small number of individuals, shows a slightly higher age at death for the males than for the females.

Sage reports an insufficient record of deaths in infancy also and discounts the value of his tables. He finds that the age of males at death is higher than that of females. Bell found the average age of 1,606 males to be 35.8 years and that of 1,352 females to be 33.4 years, a difference similar to that found in this study. His lower figures were due to the more inclusive figures upon child-mortality to be found in the Hyde genealogy. Over 35 per cent. of the total number of deaths included in Bell's study occurred before maturity was reached, whereas in the genealogies here dealt with, the record of the decease of children has been much less complete.

The correlation between longevity and fertility is next given for both fathers and mothers. In the ensuing table the ages of parental deaths are grouped into class-intervals of five years each; the figures for fathers and mothers are given separately; and under each sex are the figures showing the number of deaths for that sex dying within each class interval and the average number of children born to each at the time of death. The term, fertility, is used rather than fecundity: the former refers to the total number of children born while the latter has reference to the number of times child-birth takes place. The occurrence of twins and triplets accounts for the difference between the numbers of the two phenomena.

TABLE III. LONGEVITY AND FERTILITY.

Ages at Death	Fathers		Mothers	
	Number of Deaths	Average Number of Children	Number of Deaths	Average Number of Children
18–22	0	0.0	1	0.0
23–27	3	0.7	6	1.7
28–32	5	2.6	9	2.5
33–37	15	3.7	13	4.4
38–42	27	4.1	21	5.0
43–47	23	5.1	26	5.0
48–52	19	5.0	23	5.2
53–57	34	6.7	26	5.8
58–62	35	6.6	27	5.4
63–67	48	5.4	39	6.0
68–72	49	5.1	44	6.2
73–77	52	6.9	34	5.8
78–82	54	6.1	44	6.2
83–87	43	6.2	24	6.9
88–92	20	7.5	21	8.0
93–97	11	7.6	7	7.6
98–102	3	9.0	1	7.0
103–107	1	10.0	1	5.0

This table shows that longevity and fertility are associated phenomena as regards both fathers and mothers. A longer period of reproductive capacity can not be the sole cause since fertility continues to increase in the age-groups after the powers of fecundity have ceased, especially in the case of the mothers.

Bell reached results which are nearly identical with these. He found that the number of children per marriage rose steadily as the age of the parents at death increased. Since he used class-intervals of twenty years rather than of five years he obtained figures which afforded a steady rise in the cases of both fathers and mothers.

In the table next given the distribution of the husbands and wives is given according to their age at marriage. In the first column are given the various marriage-age groups and in the other two columns are given the frequencies, or the number of husbands and wives marrying in each of these marriage age groups.

This table shows both the median average and the modal range of the marriage ages of the husbands to be higher than

TABLE IV. DISTRIBUTION OF AGES AT MARRIAGE.

Ages at Marriage	Husbands	Wives
13–17	2	99
18–22	303	732
23–27	691	461
28–32	282	120
33–37	91	37
38–42	40	14
43–47	15	7
48–52	9	1
53–57	3	0
58–62	4	1
63–67	1	0
68–72	1	0
Median Average	25.5	21.9

that of the wives. The commonly accepted belief that males marry at older ages than females is thus shown to be in agreement with the facts.

The following table shows the distribution of the husbands and wives born in the five fifty-year periods from 1651–1900 according to their average ages at first-marriage.

TABLE V. AVERAGE AGE AT FIRST-MARRIAGE BY PERIODS.

Period	Number of Marriages	Average Age of	
		Husbands	Wives
1651–1700	27	27.0	21.4
1701–1750	176	24.8	22.2
1751–1800	272	26.7	22.6
1801–1850	553	26.9	23.1
1851–1900	501	24.8	22.3
Total	1,529	25.8	22.6

Table V shows again that the age at marriage was higher for the husbands than for the wives. No clearly marked tendency for the ages to rise or to fall is to be noted from these results.

The correlation between the marriage ages of husbands and of wives at their first marriages and their fertilities will next be dealt with. In the first column of Table VI are given the various marriage ages and in the two succeeding columns the average number of children born to the husbands and wives married at each of these ages are given.

Clear evidence is given by these figures that there is a correlation between the age at marriage and fertility,—the lowest

TABLE VI. MARRIAGE AGES AND FERTILITY.

Marriage Ages	Average Number of Children for	
	Husbands	Wives
13–17	6.0	5.6
18–22	4.6	4.6
23–27	4.4	3.8
28–32	3.3	3.0
33–37	3.6	2.1
38–42	2.9	.9
43–47	2.7	.0
48–52	.8	.0
53–57	1.3	..
58 62	1.0	.0
63–67	1.0	..
68–72	.0	..

ages at marriage being associated with the greatest fertilities. This conclusion is of interest in connection with the problem of differential birth rates, since the portions of the population having the lowest ages at marriage possess the greatest childbearing capacity to influence the composition of the next generation.

Next comes the fertility of parents by fifty-year periods. The children listed in each fifty-year period are those born within the period in question. The results are tabulated by fifty-year periods, the number of parental couples, the number of children born to them, and the average number which each parental couple gives birth to. The number of parental couples includes all of those grouped under any one period rather than the number giving birth to children. While the table is thus more correctly a measure of the fertility of the total number of married couples than of the fertilities of parents, the latter designation will be used, since those married couples with no children will be considered as having zero fertilities.

TABLE VII. FERTILITY OF PARENTS BY PERIODS.

Period	Number of Parental Couples	Number of Children	Children Per Married Couple
1651–1700	37	214	5.8
1701–1750	139	802	5.9
1751–1800	419	2,506	6.1
1801–1850	1,542	7,459	4.8
1851–1900	1,739	5,348	3.0
Total	3,876	16,329	4.2

The foregoing table shows a gradual rise in the fertility from 1650 until the close of the eighteenth century and a subsequent fall in the fertility during the course of the nineteenth century.

Table VIII shows the number of times of occurrence for each number of siblings from zero to twenty. Thus the table shows how many times there were zero children in the family, one child, two children, etc. The data are presented by the totals and subtotals for each fifty-year period also. The first column shows the number of children per family or the number of siblings, the next five columns contain the figures for the five fifty-year periods, and the final column gives the total number of occurrences for each number of siblings born.

TABLE VIII. OCCURRENCES OF SIBLINGS.

Number of Siblings	1651-1700	1701-1750	1751-1800	1801-1850	1851-1900	Total
0	4	5	33	64	116	222
1	0	7	17	137	358	519
2	3	7	39	206	373	628
3	0	14	25	203	300	542
4	2	12	40	210	217	481
5	7	20	36	140	135	338
6	5	12	38	150	79	284
7	4	17	45	110	69	245
8	6	14	37	109	41	207
9	3	11	32	67	28	141
10	2	10	27	58	14	111
11	1	7	23	41	7	79
12	0	0	10	26	1	37
13	0	2	10	16	0	28
14	0	0	2	3	1	6
15	0	1	3	2	0	6
16	0	0	0	0	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	1	0	0	1
20	0	0	1	0	0	1
Total	37	139	419	1,542	1,739	3,876
Average	5.8	5.9	6.1	4.8	3.0	4.2

Table VIII furnishes the data from which the percentages of the total number of families during each fifty-year period which had less than six children may be calculated. These figures for the five fifty-year periods from 1651 to 1900 were respectively .43, .48, .46, .62, and .86. A decrease in the percentage of families having over five children and an increase in the percentage of families having five or fewer children during each half of the nineteenth century is thus shown.

The modal figures for each fifty-year period may be obtained from Table VIII. From 1651 until 1800 these figures ranged from four to eight inclusive; from 1801 until 1850 they ranged from two to six inclusive; and from 1851 until 1900 they ranged from one to three inclusive. The families with the largest number of children were found during the period from 1751 until 1800, with the periods upon either side running close behind. If it were possible to get genealogical data showing the number of siblings born to the families during the past twenty years, undoubtedly smaller figures would be obtained than for the preceding period.

The subject of the ratio of sexes at birth is the next to be considered. The results are tabulated by fifty-year periods, according to the number of males and the number of females born in each of the periods; and according to the number of males born during each period for each 1,000 females. The last column thus affords the basis for determining the ratio of the sexes at birth, or the intensity of masculinity.

TABLE IX. RATIO OF SEXES AT BIRTH.

Period	Number of Males	Number of Females	Males Per 1,000 Females
1651–1700	111	103	1,077
1701–1750	418	384	1,089
1751–1800	1,290	1,208	1,067
1801–1850	3,838	3,621	1,059
1851–1900	2,693	2,655	1,014
Total	8,350	7,971	1,047

Sage obtained figures radically different from the foregoing. He found the ratio from 1621 to 1850 to be 1,350 to 1,000, and 131 test families had a ratio of 1,180 to 1,000. As he suggests, the cause for these ratios was probably the failure to record many female children in the genealogies with which he worked. Lewis, in "Natality and Fecundity" (9), found that the masculinity of the births of Scotland of the year 1855 was 1,049, a figure differing but slightly from 1,047, our figure for the masculinity of the total births.

The intervals between births will next be dealt with. The subject has received increasing attention recently from students of population. Table X shows the average number of years between births for each number of cases which afford the bases for these averages.

TABLE X. INTERVALS BETWEEN BIRTHS, BY NUMBER OF CHILDREN.

Number of Children	Number of Occurrences	Average Interval in Years
2	282	3.9
3	242	3.4
4	265	3.2
5	226	3.1
6	154	2.7
7	141	2.6
8	112	2.5
9	98	2.3
10	68	2.3
11	52	2.2
12	25	2.1
13	13	2.0
14	7	1.9
15	4	1.8
16	..	..
17	..	..
18	..	..
19	1	1.6
20	1	1.8

A steady and unbroken fall in the intervals between births is to be noted as the number of children in the family increases. As was to be expected, those families with the smallest number of children have the largest intervals between births and those families with the largest number of children have the shortest intervals between births. The high degree of correlation between the two conditions, as is shown by these figures, should be of interest to all concerned with the sizes of families and differential fertility rates among the various groupings of the total population.

Since the birth rate has fallen during the recent periods, and since the intervals between births increases as the fertility per family decreases, it is of interest to note to what extent the population as a whole shows evidence of a gradual lengthening of the intervals between births during the successive fifty-year periods. The following table presents figures which make for the validity of this disclosure. The data are tabulated by fifty-year periods, the number of cases which afford the bases for the averages, and the average intervals between births for each of the periods being set forth. The average for each period was found by obtaining the arithmetical mean for the average interval between births for each family having fecundity within that period. The objection may be raised that this average gives a weighting of one to each family. However, a sufficiently large enough number of items have been taken in each case to make the results of this method of weighting nearly the same as those obtained by any other method of weighting.

TABLE XI. INTERVALS BETWEEN BIRTHS BY PERIODS.

Fifty-Year Periods	Number of Occurrences	Average Interval
1651–1700	34	2.47
1701–1750	111	2.52
1751–1800	215	2.57
1801–1850	667	3.34
1851–1900	567	3.41

From 1651 to 1800 the fertility of the population and the average interval between births both remained so nearly stationary as to afford no basis for drawing any conclusions. From 1801 to 1900 there was a marked decline in the rate of fertility, as is shown by Table VII, and an equally marked increase in the average interval between births emerges in Table XI. Adequate proof is thus given to the contention that correlative to the decline in fertility which took place during the nineteenth century there was also an increase in the average interval between births. The increase in the intervals between births might serve to lower the fertility from eight to six, or any other corresponding drop, but could not suffice to account for the whole range of the drop which actually took place.

The question of the intervals between births has a close intimacy with the welfare of the children actually born. Various writers have dealt with this problem. Guyer, in "Being Well Born" (6), page 166, says that too short an interval between childbirths would seem to be an infringement on the rights of the child as well as of the mother. Ewart, in "The Influence of Parental Age on Offspring" (5), page 211, writes that children born at intervals of less than two years after the birth of the previous child still show at the age of six a notable deficiency in height, weight, and intelligence, when compared with the children born after a longer interval, or even with firstborn children. Ploetz, in "Neo-Malthusianism and Race Hygiene" (13), page 186, asserts that Neo-Malthusianism further affects the quality of the offspring by increasing the intervals between births. In families in which the parents intend to have only a few children, the mother is usually exempt from so frequent childbearing and she has ample time for regaining her strength.

The subject of twinning is the next to demand discussion. Eighty-seven cases were recorded, fifty-five of which occasioned the birth of children of the same sex while thirty-two resulted in the birth of children of the opposite sexes. No information can be given as to the number of identical twins coming from the same oosperm and as to the number of twins coming from separate oosperms, since nothing but the identical dates of birth were afforded in any case to know of the fact of twinning. The distribution of these cases of twinning throughout the reproductive period of the mother were as follows: eighteen were firstbirths, thirteen occurred during the middle of the mother's reproductive period, and fifty-six occurred at the end of that. The large majority covered in the last figure, coupled with the fact that nearly all of the cases of twinning occurred in large families, affords support for the hypothesis that twinning is associated with a waning capacity of fecundity. The eighty-seven cases of twinning included three families each having two pairs of twins. In each of these cases the twins came at the end of a large family of children.

From the distribution of the cases of twinning among the five genealogies it would seem safe to draw the conclusion that twinning does run in families and may be inherited in some very definite manner. In the following table the number of individuals in each of the five genealogies is included and the number of cases of twinning in each is shown.

TABLE XII. DISTRIBUTION OF CASES OF TWINNING BY GENEALOGIES.

Genealogy Letter	Number of Individuals	Cases of Twinning
A	4,184	11
B	4,116	32
C	4,147	11
D	3,421	25
E	4,744	8

The table shows that, for the number of individuals included, two of the genealogies present about three times as many cases of twinning as do the other three genealogies. Bell says, in "The Duration of Life and the Conditions Associated with Longevity," chapter 1, that due to interbreeding the persons listed in any genealogy constitute a sample of the general population rather than a sample of a particular family in which family traits might be expected to make their appearance. It is readily granted that every genealogy contains an admixture of many different strains of the population due to constant intermarriage, but this does not seem to constitute an adequate reason for denying the inheritance of certain family traits through successive generations. Indeed, studies of polydactylism, syndactylism, web-footedness, chorea, feeblemindedness, and insanity show that these characteristics are inherited in families, and this despite the factor of constant intermarriage. Hence it is probably no less warrantable to conclude that twinning is a trait definitely inherited in certain strains of the population.

After his study of the Scottish population statistics for the year 1855, Duncan declared that fertility in twins of wives-mothers gradually increases up to a climax at the age of 35–39, remains high even after 40, and vanishes rapidly after the age of 44. The fertility in twins is inverse to the natality in general: the former increases and the latter decreases as the age of the wife-mother advances.

The problem of the firstborn children which is now to be dealt with receives a ray of illumination from the genealogies, since they afford a most satisfactory means for comparing the fecundity of the firstborns with that of the total population. The capacity to survive until maturity and to reproduce themselves is the measure thus taken as the basis of comparison. The genealogies afford no means of discovering directly the relative capacities of the individual firstborn children and of the other children. The measure of the capacity to reach adult age and to give birth to a population commensurate with their numbers does function, however, as a test of the general viability and vitality of the firstborns as compared with that of the total population. In Table XIII, the average fertility of the total population stock included in the genealogies and of the firstborns is compared both for the fifty-year periods and for the entire period from 1651 to 1900.

TABLE XIII. FECUNDITY OF FIRSTBORN CHILDREN.

Period	Average Fertility of Total Stock	Average Fertility of Firstborns
1651-1700	5.8	6.4
1701-1750	5.9	5.8
1751-1800	6.1	5.7
1801-1850	4.8	4.9
1851-1900	3.0	2.8
Total	4.2	4.0

This table shows that the fertility of the firstborns who married was practically the same as the fertility of the total stock,—the slight difference between 4.2 and 4.0 being relatively small. The table is valueless, however, until a supplementary table is added which shows the relative percentages of the total population stock and of the firstborns who married and thus affords the basis for the table just given.

The following table gives the percentages of the total population stock and of the firstborns who married within each fifty-year period and within the whole period from 1651 to 1900.

TABLE XIV. PERCENTAGE OF POPULATION AND OF FIRSTBORNS MARRIED.

Period	Percent Married of Total Stock	Percent Married of Firstborns
1651-1700	.76	.77
1701-1750	.72	.71
1751-1800	.74	.73
1801-1850	.69	.69
1851-1900	.62	.60
Total	.69	.69

The foregoing table shows that the percentage of the total number of children born who married was the same as the percentage of the firstborn children who married. The results of the last two tables may now be combined. The first shows that the percentages of the total stock and of the firstborns who marry are the same, and the second shows that of those who do marry the fertility of the firstborns and of the total stock are practically the same. Hence the conclusion is justified that in so far as the powers of fecundity and fertility are concerned, that the firstborn children are neither above nor below the average set by the total population stock. While the studies into other phases of the problem may show a handicapping of the firstborn children in some instances, or may fail to do so in others, the evidence given by these figures seems quite incontrovertible that in so far as the factor of fecundity is concerned, the firstborn children are neither aided nor retarded by their position of birth.

Table I–XIV may be summarized as follows: Remarriages occurred three times as often among the men as among the women. No conclusions of any validity could be drawn concerning the duration of life over the different periods since many cases of infant mortality were not recorded in the early periods. In this study as in those done by Bell and by Sage, the ages of the males at death as recorded are higher than the ages of the females. A high correlation is shown between longevity or duration of life and fertility for both fathers and mothers. The table giving the distribution of the ages at marriage of husbands and wives shows that the husbands married at later ages than did the wives. The table giving the average ages of husbands and wives at marriage by fifty-year periods affords no basis for drawing any conclusion concerning a rise or fall in the age at marriage. A high correlation appears between the marriage age and the fertility of both fathers and mothers. The fertility of parents is found to increase slightly during the years from 1651 to 1800 and to decrease noticeably during the years from 1801 to 1900. The modal number of children per family during the five fifty-year periods from 1651 to 1900 shows a decrease from four to eight from 1651 to 1800 down to two to six from 1801 to 1850 and to one to three from 1851 to 1900. The table showing the ratio of the sexes at birth shows an intensity of masculinity of 1,047 or a ration of 1,047 males to every 1,000 females. The average interval between births appears to decrease as the number of children in the family increases, and it is also shown that the average interval between births was from 30 to 40 per cent. greater dring the nineteenth century than it was during the eighteenth. The data about twinning show that the majority of cases occurred near the close of the reproductive period of the mother and that twinning probably ran in certain families. Finally, in dealing with the problem of the firstborn children it is shown that the fertility of the firstborns was neither above nor below that of the population strains which were dealt with taken as a whole.

As this summary would suggest, the aim of the whole work has been to obtain exact and concise information in regard to all of the subjects which have been under discussion. While the immediate purposes involved made it necessary that all interpretations become secondary and ancillary to the actual processes of compilation and tabulation, the more ultimate goal to be desired is that the resulting presentation may serve as supplementary source material to the censuses in obtaining statistical information in respect to the phenomena of population which have been under investigation.

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NOTICE TO MEMBERS.

By vote of the Board of Directors, the price of the publications of our Association will hereafter be $3.00 per annum; and the price per volume has been increased from $4.00 to $6.00. The Board has decided to allow single numbers to be sold at the usual price. This change is, of course, subject to ratification at the Annual Meeting of the Association, which no doubt will be obtained. It is proper, however, that subscribers should be given notice in advance.

The Editor.

REVIEWS AND NOTES.

TWO LETTERS FROM G. H. KNIBBS, C.M.G., F.S.S., THE COMMONWEALTH STATISTICIAN OF AUSTRALIA.

(The following letters, which the Editor ventures to publish without having sought Mr. Knibbs' permission, are printed not so much for his complimentary remarks about the Memorial Volume but for his views on statistics, national as well as international. They are dated Melbourne, the 28th of June and the 23rd of July, 1918.)

"Your kind letter of 13th May has been in my hands for a little while, and today brought the History of Statistics, the memorial volume to commemorate the 75th anniversary of the American Statistical Association. It is a magnificent and very valuable volume and I am indeed glad to have a copy. I congratulate you most heartily upon its compilation and in view of the world's future it is obvious that a work of this kind was needed, and further, that the statistician will have to be the guide of governments as he was in the Statistisches Reichsamt in Berlin. I hope that legislating in the dark will be soon a thing of the past and that all nations worthy of the name will watch the trend of affairs in the light of the facts which a proper scheme of statistics would systematically record. . . .

"Facts brought to light during this great war have revealed the necessity of watching the food supply and the rate at which our industrial raw material is being exploited. I hope to lay the foundations of good practical systems of statistical methodology before I finish my statistical career, as I feel sure that the world will not be able to live in the future in the haphazard way it has in the past. Mankind is moving towards some great cataclysm or towards a higher evolution—one does not know which—but the deviltry of this war has shown that the human race must either recognize its solidarity or be prepared for conflicts compared with which the present war will be a mere circumstance."

"Since writing you on the 28th June I have had a little time to look into the very fine collection of papers preceded by your Presidential address of 13th February, 1914, on the History of the American Statistical Association. The whole idea is very happily conceived and it is interesting to notice that the Association has passed through its period of difficulty and has come out satisfactorily. There are some remarks in S. N. D. North's paper that are very much to the point. For example:—"The days of the laissez faire have gone forever. There is no longer any field of human activity into which it is not now accepted as both the right and the duty of the state to intervene, by investigation and remedial action."

"I am satisfied that every country which intends to be in the first rank of nations will have to make a thorough study of its affairs and guide the development of its people both eugenically and economically. The old "go-as-you-please" system *must* disappear. Statistics used for the benefit of the people will replace the old use by monarchs of the Frederick the Great type. Really international statistics will, moreover, bring into relief the real questions for international settlement, viz., questions touching the standard of living, the rate of procreation, cosmopolitical economy, and all matters affecting the solidarity of the human race; for example, international services, the trade arrangements between nations, the regulations of productivity, the desirability or otherwise of the anonymity of capital.

"The thinkers of the world have not as yet resolutely faced these questions, nor have they faced the question whether we are to be under the guidance of the superior type of demagogue or under the guidance of the most capable and strenuous men of our day and generation, *i. e.*, under the guidance of the real aristocrats. You remember Carlyle's estimate of the mass of people. The political arena shews that appeals to passion and prejudice are more effectual than appeals to the higher elements of our being. Internationally, we appear still to be as dangerous as the shark tribes are to one another. The idea of international solidarity has been born but its light is very feeble. One can hardly say it is yet incarnate, but if we are to end the war we have a long way to go in the direction of the recognition of mutual rights. Fierce and ruthless struggle would mean a very bad time for the world for the instruments of destruction have become very terrible and must soon become still more so.

"Your idea was a very happy one and the matter in this commemorative volume will do much to bring about a popular realisation of the fact that the statistician and statistical method must be used not less in national affairs than it is in private business. The guidance of national development is of incalculable importance, and the present abominable war has shewn that we are not entitled to let matters drift. There is an immense field to be covered but there will be no difficulty in dealing with it if we endeavor to handle the whole problem systematically.

"Again warmly congratulating you,

"Believe me,
"Yours very sincerely,
"G. H. Knibbs."

Census of Prairie Provinces, Population and Agriculture, 1916, Census and Statistics Office, Ministry of Trade and Commerce, Ottawa, J. de Labroquerie Taché, 1918.

An important contribution to American census material comes to hand in the complete edition of the 1916 population and agricultural census of the Canadian "Prairie Provinces," Manitoba, Saskatchewan, and Alberta. This census is one of a series of decennial censuses, 1906, 1916, etc. The information was apparently tabulated with most commendable promptness, since it was published early in 1917 in the form of three separate reports, one for each province. Here we have an excellent illustration of the publication of information while it is still fresh and applicable to existing conditions. It is very gratifying to find an example so worthy of imitation appearing in war times, in the face of every difficulty, and with the opportunity for perfectly plausible excuses for delay.

In view of the present food situation, Part II, relating to Agriculture, will be studied with great interest by statesmen, economists, and statisticians. The value of the census is, of course, enhanced by the fact of its being one of a series. Such a table as that on page 300, showing the comparative yields of the principal field crops in 1905, 1910, and 1915, is invaluable as providing means for making estimates for years subsequent to 1915. For instance, it appears at a glance that the total production of the principal crops in the prairie provinces has more than tripled in ten years, a rate of increase very promising for the future.

But to draw a single salient fact from such a wealth of material is almost to misrepresent it; the uses of such a census are as numerous as the ends and purposes of those who use it. This census is clearly of very great potential utility to American statisticans, who may venture, herewith to express their respectful thanks to the Canadian Ministry of Trade and Commerce, and to the staff of the Office of the Census and Statistics.

Fourteen pages of summary tables and analysis, and about 280 pages of analytical tables are devoted to population. It is interesting to find significant items, such as religion, and housing, among the usual topics: age and sex distribution, conjugal condition, origin, language, and literacy. Twenty-two pages of analysis, based on 73 pages of detailed data, are given to agriculture. The statistics include: farm areas, field crops, fruits, animals animal products, and labor and wages.

LOUIS I. DUBLIN.

NEW SERIES, No. 125. (VOL. XVI.) MARCH, 1919

QUARTERLY PUBLICATIONS OF THE
AMERICAN
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III. THE STATISTICAL WORK OF THE WAR INDUSTRIES BOARD. By Leo Wolman.

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VI. A ROUND TABLE DISCUSSION OF FEDERAL STATISTICS.

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VIII. REVIEWS AND NOTES: Uniform Statistics of Mental Diseases in the United States, *E. W. Kopf.* Statistical Study of the Influenza Epidemic, *E. W. Kopf.*

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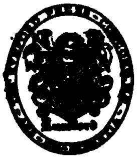

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 125. MARCH, 1919

STATISTICS AND GOVERNMENT.*

By Wesley C. Mitchell.

Since the American Statistical Association was founded in 1839 no year has brought such stirring changes in American statistics as the year now closing. The war forced a rapid expansion in the scope of federal statistics and the creation of new statistical agencies. What is more significant, the war led to the use of statistics, not only as a record of what had happened, but also as a vital factor in planning what should be done. The war also brought an unprecedentedly large number of statisticians into government employ. Probably there are few professional societies which have had so considerable a proportion of their membership engaged in war work as this Association.

Tonight we feel a just pride in the service our fellow members have rendered. We cherish the hope that what they have helped to accomplish during the war toward the guidance of public policy by quantitative knowledge of social fact may not be lost in the period of reconstruction through which we are passing, and in the indefinite period of peace upon which we are about to enter. To forward that hope the Association may seek a more active share in the work of federal statistics in the future than it has ever taken in the past.

It is my pleasant task tonight to speak of these things—our work in the year that has gone, our hopes for the years to come, and what we may do in the present toward achieving these hopes.

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*Presidential address at the eightieth Annual Meeting of the American Statistical Association, Richmond, Virginia, December, 1918.

I.

Dr. Cummings's review of Federal Statistics in our Memorial Volume shows that before the war there were more than a score of statistical bureaus in Washington publishing thousands of pages of figures each year. But there was no coördinating agency, no bureau whose duty it was to consider the statistical needs of the government as a whole and to formulate systematic plans for supplying these needs. Hence, there was duplication of work, no one knows exactly how much; many important fields were imperfectly covered, or not covered at all; the results of different bureaus could not be compared or combined readily because of differences in units used, in periods covered, and in classification; finally, the cost of federal statistics was needlessly high. To remedy these defects of organization Committees on Federal Statistics appointed by this Association and the Economic Association had endeavored to secure the appointment of a Central Statistical Commission; but they had met with little encouragement. As one member of these committees, I confess that our efforts had not been vigorously pushed.

The war revealed the defects of the federal machinery for collecting statistics with startling suddenness; for war imposes a strain upon statistical offices quite as much as upon steel mills, or shipyards. As Professor Young said in his presidential address last year, "War has come to be a conflict of directed masses,—of aggregates. Men, money, munitions, food, railways, shipping, raw materials, and manufactured products in great variety are impressed into the service of the nation. The problems of the effective control and use for war purposes of these varied national resources is intimately dependent upon a knowledge of their quantities, that is, upon statistics. . . . Just as this war is our largest national undertaking, so its statistical demands constitute, in the aggregate, the largest statistical problem with which we have had to deal."

We were not prepared to cope with this problem. It is not to be expected, of course, that the statistical output of peaceful years will include all the data required for waging war. But it *is* to be expected that a governmental organization for gathering statistics will grasp a new statistical problem promptly and prepare plans for treating that problem with vigor. This test our federal bureaus failed to meet.

The fault was emphatically a fault of organization rather than of individual officials. Whatever charges of incapacity are made against the officials themselves properly should be made against the system under which federal statisticians are chosen and rewarded. For they are not chosen with an eye single to technical skill and administrative capacity; they are not paid salaries sufficient to attract and retain men of uncommon ability and ambition; the inadequate salaries are not compensated by public recognition of efficient service. We had, indeed, many federal statisticians better than our treatment deserved,—men who served the country with zeal and intelligence. But, scattered through numerous small bureaus, prescribed a set routine of departmental duties, granted scanty appropriations, these men had little chance to consider the vast new problems of the war. They certainly did not, perhaps they could not, come forward with an efficient war program.

For this shortcoming of our statistical organization we paid a heavy penalty. The time we spent in framing our war organization and getting it started might have been substantially shortened had anybody in Washington been able to put before the responsible authorities promptly the data they needed concerning men and commodities, ships and factories.

What did happen made an admirable exhibition of national energy and patriotism, but not a good exhibition of national intelligence. The War Boards which the government set up to supplement the regular departments faced stupendous tasks. They were led and manned for the most part by men inexperienced in public administration, and unacquainted with the duties and resources of the federal departments. While these men were in the throes of laying their plans, and forming their staffs, they had also to find out that they needed statistics, what statistics they needed, and how to get them. Although the federal government entered the war with twenty or more statistical agencies, the Council of National Defense, the Food Administration, the Fuel Administration, the Shipping Board, the War Trade Board, the Railway Administration, and the

War Industries Board, sooner or later set up each a new and independent statistical agency to meet its special needs. The War Department and the Navy Department followed suit. And these agencies, like the War Boards which created them, had to be manned with people inexperienced in government work and unfamiliar with Washington.

Although I was one of the raw recruits pressed into emergency work for the government, I cannot forbear speaking of the fine qualities which the new statistical staffs showed. Each group studied the particular needs of the board which it served, and threw itself ardently into the task of collecting data. The new men worked with passionate intensity. They were appalled by no obstacles. Where they could not get definite data, they did not hesitate to estimate. The motto adopted by one of the leaders expressed the spirit of all: "It can't be done? But here it is."

Yet the statistical work of the War Boards as a whole showed precisely the same defect as the organization of the old statistical bureaus, and showed that fault in an aggravated degree. Each new agency worked by itself for a separate board. Hence there was much duplication of effort, and at the same time many important fields remained unworked; the results reached by different agencies could not be readily compared or combined: and the cost was needlessly great. Further, the energy of the new statistical agencies and the haste in which they worked magnified a minor fault of the old system to large proportions. These new agencies wanted to get their fundamental data from the original sources; so they sent out questionnaires to business men in a veritable flood. Many manufacturing plants got elaborate papers which they were asked to fill out and return by the next mail in tens and in dozens. Frequently, different questionnaires covered nearly the same ground, and usually they required not a little investigation within the plant to collect the data asked for. Considerable expense and serious irritation was caused throughout the country by this obvious failure of organization in Washington.

This questionnaire evil brought back a flood of complaints, echoes of which reached the responsible heads of the War

Boards. The efficiency of economic mobilization seemed threatened; that was a more serious matter than the waste of public funds. The men who were most keenly aware of the lack of coördination in statistical work now had a strong talking point. Steps were presently taken to remedy a fault which had been patent for a generation or more on a peace basis. The head of the Division of Planning and Statistics of the Shipping Board was put in charge of the Bureau of Research of the War Trade Board, and then of the Division of Planning and Statistics of the War Industries Board. Thus three of the new statistical agencies were brought under a single direction. Later the same man became chairman of the Statistical Committee of the Department of Labor, and finally he was authorized to form a Central Bureau of Planning and Statistics. The Central Bureau set up a clearing house of statistical activities, appointed contact men to keep touch with the statistical work of all the War Boards and certain of the old departments, and began to supervise the issuing of questionnaires. When the armistice was signed we were in a fair way to develop for the first time a systematic organization of federal statistics.

For the first few weeks after the fighting stopped, it seemed as if what had been gained in statistical organization might be lost almost at once. The rapid demobilization of the War Boards threatened to sweep with it their statistical bureaus, or to scatter the new statistical bureaus among the old departments and leave us again in statistical confusion—making figures in abundance but having no general statistical plan. But at a critical moment President Wilson approved a plan by which the Central Bureau of Planning and Statistics was made the single statistical agency to serve the American conferees at the Peace Table. Thus, the Central Bureau was granted a reprieve for some months. It still remains to be seen whether this bureau or some successor serving the same centralizing functions will be made permanent.

II.

In speaking next of our hopes for the future, I am speaking merely as one member of the American Statistical Association.

Yet I believe that most members of our Association believe that the social sciences in general and social statistics in particular have a great service to render to government and through government to mankind.

The episode in statistical organization which I have sketched, the effect of the war upon our attitude toward the use of facts for the guidance of policy, links the present stage of civilisation with man's savage past. Anthropologists have come to recognize that catastrophes have played a leading rôle in advancing culture. The savage and the barbarian are such conservative creatures that nothing short of a catastrophe can shake them out of their settled habits, make them critical of old taboos, drive them to use their intelligence freely. In physical science and in industrial technique, it is true, we have emancipated ourselves largely from the savage dependence upon catastrophes for progress. For in these fields of activity, we have developed a habit of criticising old formulations, of testing what our fathers accepted, of experimenting. We keep discarding the good for the better, even when not under pressure. The result is a fairly steady rate of advance,—advance so regular that we count upon it in laying plans for the future. Today we are sure that ten years hence our present scientific ideas and our present industrial machinery will be antiquated in good part. In science and in industry, we are radicals,—radicals relying on a tested method. But in matters of social organization we retain a large part of the conservatism characteristic of the savage mind. A great catastrophe may force us for a little while to take the problems of social mobilization seriously. While under stress we make rapid progress. But when the stress is past we relapse gratefully into our comfortable faith in the thinking that has been done for us by our fathers.

I know that there are ardent folk who will challenge these contentions at least for the present. They trust that the outburst of patriotic fervor brought by the war will carry us triumphantly forward for a generation. They count on the generous self-sacrifice which all classes have shown, the fine discipline that our soldiers and war workers have maintained, to solve the problems of peace as they solved the problem of war. Certainly we shall never be again precisely what we were before the war. But just as certainly we shall not remain what we have been during the war. We are all subject to emotional reactions, and, as John Dewey has pointed out, the state of mind produced by the return of peace differs from that produced by the outbreak of war just as widely as peace itself differs from war. No, we cannot depend on any carry-over of "war psychology" to organize democracy in peace.

The "social reformer" we have always with us, it is true. Or rather most of us are "social reformers" of some kind. And we all admire the qualities that go to make the leaders in social reform—warm sympathy for the oppressed, courage to face ridicule, flaming zeal in the face of indifference, tact and energy in conducting crusades. But an indefinite succession of campaigns to secure this, that and the other specific reform is what we have been having for a long, long time. Many of the reforms on which our grandfathers, our fathers, and our youthful selves have set their hearts have been achieved. Yet the story of the past in matters of social organization is not a story that we should like to have continued for a thousand and one years. Reform by agitation or class struggle is a jerky way of moving forward, uncomfortable and wasteful of energy. Are we not intelligent enough to devise a steadier and a more certain method of progress?

Most certainly, we could not keep social organization what it is even if we wanted to. We are not emerging from the hazards of war into a safe world. On the contrary, the world is a very dangerous place for a society framed as ours is, and I for one am glad of it. The dangers are increased by our very progress in industry and in democracy. Not long ago an English physicist reëmphasized the fact that modern Christendom is using up at an ever-increasing pace the energy stored during long ages in the coal fields, and pictured the doubtful fate of human kind as hanging on the race between science and the atom. Has not the time come to apply our intelligence to taking stock of the resources that the earth still holds and to developing methods of utilization that will protect our future? As for democratic progress, we know that men who can read and vote make restless citizens in a state where their work is not interesting to them and where their rewards do not satisfy their sense of justice. And such is the present state of affairs with millions of aggressive Americans. They can be counted upon to change things by turmoil if things are not changed by method.

Taking us all together as one people in a group of mighty peoples our first and foremost concern is to develop some way of carrying on the infinitely complicated processes of modern industry and inter-change day by day, despite all tedium and fatigue, and yet keeping ourselves interested in our work and contented with the division of the product. That is a task of supreme difficulty—a task that calls for intelligent experimenting and detailed planning rather than for agitation or class struggle. What is lacking to achieve that end, indeed, is not so much good will as it is knowledge—above all, knowledge of human behavior.

Our best hope for the future lies in the extension to social organization of the methods which we already employ in our most progressive fields of effort. In science and in industry, I have said, we do not wait for catastrophes to force new ways upon us. We do not rely upon the propelling power of great emotion. We rely, and with success, upon quantitative analysis to point the way; and we advance because we are constantly improving and applying such analysis.

While I think that the development of social science offers more hope for solving our social problems than any other line of endeavor, I do not claim that these sciences in their present state are very serviceable. They are immature, speculative, filled with controversies. Their most energetic exponents are still in the stage of developing new "viewpoints," beginning over again on a different plan instead of carrying further the analysis of their predecessors. In part the social sciences represent not what is so much as what their writers think ought to be. In short, the social sciences are still childish. Nor have we any certain assurance that they will ever grow into robust manhood, no matter what care we lavish upon them. There are blind leads of speculation in which past generations have mined industriously for ages with little gain. Perhaps the social sciences will prove more like metaphysics than like mechanics, more like theology than like chemistry. The race may always shape its larger destinies by a confused struggle in which force and fraud, good intentions, fiery zeal, and rule of thumb are more potent factors than measurement and planning. Those of us who are concerned with the social sciences, then, are engaged in an uncertain enterprise; perhaps we shall win no great treasures for mankind. But certainly it is our task to work out this lead with all the intelligence and the energy we possess until its richness or sterility be demonstrated.

The social sciences, however, cover an immense field, and it is not probable that we shall encounter failure or success in all its parts. The parts where effort seems most promising just now are the parts in which this Association is particularly interested. Measurement is one of the outstanding characteristics of science at large, whether in the field of inorganic matter or life processes. Social statistics, which is concerned with the measurement of social phenomena, has many of the progressive features of the physical sciences. It shows forthright progress in knowledge of fact, in technique of analysis, and in refinement of results. It is amenable to mathematical formulation. It is capable of forecasting group phenomena. It is objective. A statistician is usually either right or wrong, and his successors can demonstrate which. Statisticians are not continually beginning their science all over again by developing new viewpoints. Where one investigator stops, the next investigator begins with larger collections of data, with extensions into fresh fields, or with more powerful methods of analysis. In all these respects, the position and prospects of social statistics are more like the position and prospects of the natural sciences than like those of the social sciences.

Above all, social statistics even in its present state is directly applicable over a wide range in the management of practical affairs, particularly the affairs of government. And this practical value of statistics is readily demonstrable even to a busy executive. Once secure a quantitative statement of the crucial elements in an official's problem, draw it up in concise form, illuminate the tables with a chart or two, bind the memorandum in an attractive cover tied with a neat bow-knot, and it is the exceptional man who will reject your aid. Thereafter your trouble will be not to get your statistics used, but to meet the continual calls for more figures, and to prevent your convert from taking your estimates more literally than you take them yourself.

We may well cherish high hopes for the immediate future of social statistics. In contributing toward a quantitative knowledge of social facts, in putting this knowledge at the disposal of responsible officials, we are contributing a crucially-important part toward achieving the gravest task that confronts mankind today—the task of developing a method by which we may make cumulative progress in social organisation.

III.

What can the American Statistical Association do toward realizing these hopes? Of course, that is for the Association to decide; but I venture to submit certain recommendations to the Association's judgment.

My plea is that the Association seek to play a more active rôle in public affairs than it has played in the past. We are holding our eightieth annual meeting—few learned societies in this country are so old. Through all these years we have been mainly a learned society, cherishing our particular subject, criticising those who neglect or misuse it, occasionally proffering advice, summing up experience, but not participating aggressively in the rough and tumble of statistical practice. All this kind of work has been serviceable. Certainly conditions in Washington and the state capitals have made participation by outsiders in official statistics exceedingly difficult. But conditions have changed somewhat and if we do our part with vigor they may change more.

Two changes seem to me especially promising. One is the active share that many members of the Association have taken in war work. These men will not entirely lose their interest in federal statistics when they leave Washington. For the next few years at least we shall have a corps of workers who know a good deal about conditions under which government figures are compiled and used. These men will help to make the Association practical in any advice it may tender. Because of them we have greater capacity to do serviceable work now than we ever had before. The Association can be more helpful because it knows more and cares more about what the government bureaus do.

The second change is in the attitude of Washington officials toward the work of outsiders. Just as those of us who have been in government service temporarily have gained a sympathetic insight into the difficulties faced by the permanent statistical bureaus, so the members of the permanent bureaus have become better acquainted with the viewpoint of outside statisticians. They have listened to our criticisms; in turn, they have criticised many of our suggestions for improving their organization and practices. As a result, they know how to utilize our services better than they did before the war. And they are, I think, not unwilling to annul the divorce between working statistician and academic critic and enter into a new relationship of mutual understanding and coöperation.

One symptom of this new attitude is so gratifying that I cannot forbear calling especial attention to it. The Secretary of Commerce has asked the president of the American Economic Association and the president of the Statistical Association to appoint each a committee of three to advise with the Director of the Census on matters of statistical principle and on the selection of statistical experts. This arrangement, it is hoped, will be no formal affair; but a working plan by which the producers and the consumers of statistics can coöperate effectively to improve the products in which both parties are interested. To provide the two committees with working facilities an office and a secretary have been furnished them by the Director of the Census.

If we do our part toward making this arrangement a success, it may perhaps lead to the establishment of other bonds between the Associations which represent the statistical public and the offices in which statistics are prepared.

There are several practical measures toward which we may contribute if we like. For example, we may use our influence whenever opportunity arises to secure more adequate salaries for government statisticians. The scale of pay was too low before the war; the increased cost of living has made it shockingly inadequate. Unless increases are granted many experienced men who would be glad to continue in public service will be compelled in justice to their families to look for openings elsewhere. Now that the war is over, we cannot justly ask these men to stint their children for the rest of us. The profession of the statistician demands ability and training not less than those needed by accountancy; yet from what I can learn, the average remuneration of statisticians is decidedly lower than that of accountants. As representing the statistical profession, it is certainly the right of this Association to urge vigorously a higher scale of salaries.

We may also take a definite stand upon the continuation of the new statistical activities begun during the war. The War Boards found it necessary to obtain monthly figures of stocks of certain commodities on hand, and monthly figures of the production of other commodities. These figures were collected in a variety of ways, by the Census Office, by trade organizations like the Tanners' Council, or by sections of the War Boards themselves. The results are of interest not only to the industries concerned, but also to the government and to the general public. The permanent maintenance of this service, perhaps in a modified form, is a measure that promises to command increasing support from business men. If systematically extended this work might well develop into a continuing census of production, simple in form, inexpensive; but of great value in forecasting business conditions and directing public policy.

Once more, there is the question which I mentioned in the first section of this address, whether the Central Bureau of Planning and Statistics is to be continued or disbanded when the Peace Conference has finished its work. Some centralizing agency to consider the statistical needs of the government as a whole, and to lay systematic plans for meeting these needs is our greatest statistical lack. On a question of this character, is it not the duty of the American Statistical Association to speak its mind?

In any action we take we shall do well to distinguish clearly between two types of statistics—the statistics that are used as a record of what has been and the statistics that are used as a basis for planning what shall be. Of these two types record statistics are the more familiar. They constitute the figures that go into annual reports, that are analyzed minutely by the student, that are quoted long after by the historian. Such figures have an influence in shaping public policies; but that influence is vague and intermittent. The average administrative official cares little about what happened day before yesterday,—his thoughts are obsessed by what is happening today and what should happen tomorrow. Any one of us in his position would develop that frame of mind if he succeeded at all. What the administrator needs to guide public policy, what he will quickly learn to use if he gets them, is well organized planning statistics. Planning statistics to be of service must be strictly up-to-date. They must show the vital factors in the situation. They must be presented concisely, in standardized form, both in charts and in tables. The data must be simple enough to be sent by telegraph and compiled overnight. Rough approximations will serve the purpose. What we need practically at present is to develop statistical agencies for obtaining such planning statistics and putting them before the men whose decisions are important to the country, whether these men be administrators, legislators, or voters. As students our concern will continue to be chiefly with record statistics—they must not be neglected, indeed they must be extended and improved. But as men interested in affairs, our emphasis must be put upon the development and the use of planning statistics.

The policy of active participation in shaping statistical work which I am urging seems to me justified by the circumstances of the day. During the war we learned that many things which seemed impossible were easy of accomplishment if attacked with vigor. Doubtless, the situation has already crystallized in part; but many matters of governmental policy are still in a fluid state. Some changes will have to take place; the question is, what shall these changes be. If we put our technical knowledge and our practical experience at the disposal of the nation, we may increase our influence for years to come, and, what is vastly more important, we may help to make quantitative knowledge of facts a potent factor in government.

STATISTICS OF THE UNITED STATES SHIPPING BOARD.*

By HORACE SECRIST.

I. INTRODUCTION.

What I shall say about the statistics of the United States Shipping Board has to do primarily, but not solely with the Division of Planning and Statistics. Of the Emergency Fleet Corporation and the Division of Operations, I shall speak briefly but only in so far as their work is related to that of the Division. Moreover, in the brief time at my disposal, I can do little more than mention the other war boards with which the Division coöperates, upon which it depends for much of its raw statistical material, and the wishes and needs of which are considered in the preparation of statistical services and reports. To do this fully would take more time than is given to me and undoubtedly would anticipate much of what is to be said by other speakers.

The Division of Planning and Statistics of the Shipping Board, at the time of its organization was unique, so far as I know, among government bureaus. It was created in response to an urgent need for the development of a plan and method in the utilization of American and American controlled foreign tonnage in the prosecution of the war. Foresight and planning were to be and have been the guiding principles in its development. The making of history, the production of finished and comparable statistical reports have constantly been sacrificed to the need for day-to-day statistics of use for planning purposes. Hence, statistical hazards—jumps in the dark, as it were—were taken when there was only the smallest chance of their being justified when viewed from any other angle than the emergency which prompted them. As fast as conditions were standardized the statistics were improved; they became more comprehensive, and more closely followed the canons imposed by approved methods.

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*Paper read at the eightieth Annual Meeting of the American Statistical Association.

II. THE PROBLEMS TO BE MET BY THE DIVISION.

At the beginning of 1918, the United States had a small merchant fleet of its own, a nascent emergency fleet, some enemy seized and requisitioned neutral vessels. Both in number and in manner of use, they were inadequate to guarantee a "bridge of ships" either for war or trade purposes. Moreover, to leave them in their accustomed trades would only aggravate the shortage. Control of imports first, and of exports later was imperative. Moreover, Government control of vessels was necessary. This was provided by requisition orders and covered not only vessels building in the United States on American and foreign account, but also vessels trading between the United States and foreign countries. Control both of vessels and of commodities seemed to guarantee against a wasteful use of United States and United States controlled foreign shipping. Administrative action and intelligent planning, however, were necessary in order that economical use might be realized. How was this secured so far as the Division of Planning and Statistics of the Shipping Board is concerned?

Study by the Commodities section of the Division unmistakably revealed the importation into the United States of "unnecessary" goods. Such use of ship tonnage could not be defended in any scheme which made "win the war by intelligently using ships" its chief sanction. This fact was patent, but to measure the amounts in long tons of such unnecessary imports, often quoted in trade statistics in values or in containers, and the equivalent ship tonnage "wasted" through such importation presented real statistical problems. These were the first, and have continued to be some of the most difficult, statistical problems of the Division.

By statistical analysis, consultation with the trade, with the Army, the Navy, the Food Administration, the State Department, and other Government agencies, an import program was finally established. In outline, this provided that the War Trade Board should license imports and that the Shipping Board should provide the necessary ship tonnage to move them. In working out this program, trade protests and diplomatic objections had to be met or circumvented. The argument, that to cut imports saved ship tonnage was true, but its application was neither seen nor welcomed at first by the interests involved. The question was asked—and later, answered—How much tonnage? It was necessary to determine the amount of savings not only to meet trade objection, but likewise to furnish a basis for the assignment of tonnage by the Shipping Board so as to guarantee that the import program in its civilian and army aspect would be met. To answer the shipping side of this question required that the following, among other problems, be studied, and that the results of such study become controlling factors in the daily administrative routine of the Division, and of the other war boards with which it coöperated.

(1) The stowage of goods in space and weight.

(2) The conversion into long tons of the values and other units in which imports are often expressed.

(3) The turn-arounds of vessels, or the time spent in completing one round trip.

(4) The unit in which to measure cargo capacity, in the study of vessel utilization.

(5) The relations between the ship tonnages in current use.

(6) The relations between the different types of vessels as carrying units.

(7) The relations of bunkers and stores to total ship tonnage in order to determine the capacity for cargo tonnage.

(8) Use and practicability of combination as contrasted with solid cargoes, and the relation of the distribution of necessary imports thereto.

(9) Suitability of vessels for various services, account being taken, among other things, of size, speed, permanent bunkers, fuel consumption, charter restrictions, etc.

(10) Ballast movements, and underloading by space and weight.

(11) Distribution of ship tonnage by trades and services.

(12) Vessel control by flag, charter, agreement, etc.

(13) Losses through marine risk and enemy action.

(14) Acquisitions to merchant fleets through building, purchase, charter, repair and salvage.

This list, though far from complete, will serve to illustrate the types of problems with which it was necessary to deal. The statistical material for their measurement had, for the most part, to be created, or secured in a crude state from widely different and frequently conflicting sources. A review of this in terms of the problems named, may be interesting. It is impossible, however, in this short paper, to develop fully any of these topics, and to criticise from a statistical point of view the sources of material and the uses to which they are put. Little more can be done than to list them.

III. SOURCES OF MATERIAL.

(1) "Cargo Reports."

These are reports made by masters of vessels to collectors of customs on vessels, (a) entering foreign, (b) clearing foreign, (c) arriving coastwise. They are made in duplicate, one copy going to the Shipping Board, and one being filed by the collector. They show (using the entering form as an example), for individual vessels, the port of entry, name, type, flag, port of origin, date of clearance, ports of call, with arrival and clearance dates; gross, net and total deadweight-tonnage; tons of bunkers, water and stores on leaving; days spent in port of origin; deadweight for cargo; total cargo on board in long tons and cubic feet; total capacity in cubic feet (bale and grain); description of cargo, showing for each of about sixty principal commodities, port of loading, long tons on board, and cubic feet of space employed; amount to be discharged at port of entry in long tons; etc.

These reports are fundamental, and supply source material on stowage, tonnages, source of imports, solid and combination cargoes, turn-arounds, delays in port; ballast movements and vessel utilization, relation of total to cargo deadweight, etc.

(2) Application for license for bunker fuel, port, sea and ship's stores and supplies.—"Bunker Form B-1."

This is a report made out in triplicate by the owner, charterer, agent or master of a vessel, and is presented to the agent of the Bureau of Transportation of the War Trade Board or to the collector of customs. One copy goes to the Shipping

Board. Among other things, this report calls for the name, flag, type, speed; registered gross, net, and total deadweight tonnage of vessels; average daily consumption of fuel in port; owner's and charterer's name, address, and nationality; date of charter party; date of expiration of charter party; trading limits, if on time charter; ports of call on last completed voyage; last port outside United States from which vessel cleared; description of complete voyage which is to be made; etc. This report when sent to the Shipping Board also contains a statement of the amount of fuel and stores actually licensed to be put on board.

This report, likewise, is fundamental in the work of the Division, throwing light, not only on the characteristics of vessels, but also on their control, trading limits, and most distinctive of all, on the relation of coal consumption to the voyage in question. By means of it, the steaming radius of a vessel and the relation of total to cargo deadweight are checked against other sources, or independently determined.

(3) Master's Report on Outward Voyage. "Bunker Form B–3."

This is a report made out by the master of the vessel at the time of completing his voyage and provides for his listing all ports of call with dates of arrival and departure; cargo and bunkers loaded and discharged, and the amount of fuel on board at place of destination. The report, although not received until the voyage is completed, is important in tracing vessel itineraries and periods of turn-around.

(4) "Charter Reports."

The Chartering Committee of the Shipping Board approves charter parties of American and foreign vessels doing foreign business with the United States and of foreign vessels doing coastwise business. A daily report on charters approved, disapproved and cancelled, is made to the Division, and gives, in addition to descriptive facts of vessels, the names of owner, chartered owner, operative charterer; form and duration of charter; trading limits, if on time charter, etc. By means of this and other reports, record is kept and studies made of American vessels chartered to foreigners; foreign vessels chartered to the United States Shipping Board or United States citizens; foreign vessels chartered to foreigners under conditions approved by the Chartering Committee; and foreign vessels trading with the United States which are specifically required to return to the United States.

(5) "Allocation Sheets"—Ship Control Committee.

Reports from the Ship Control Committee for the Shipping Board at New York are received daily. These show the allocations daily made, the operative companies, and for trans-Atlantic regions, vessels en route each way; those in home ports; those in foreign ports, and the account upon which each is moving. Somewhat similar, but far less satisfactory reports are received from the committee on vessels trading with South America, the West Indies and Caribbean points and in the Pacific.

(6) Reports from the Division of Operations, United States Shipping Board.

The Division of Planning and Statistics relies on the Division of Operations for a large amount of data on the measurements of vessels, ownership, assignment, for operation, and charter relations to the board. These and other data are made available through printed or mimeographed reports, or through daily digests of the correspondence of the Division.

(7) Reports from the United States Shipping Board Emergency Fleet Corporation.

Likewise, the Division receives from the Emergency Fleet Corporation, among other things, daily reports on keels laid, launchings and deliveries, contract measurements of vessels. Actual measurements are later substituted after vessel trials are made, and the itineraries, loading factors and general utilization of Emergency Fleet vessels watched in the same way as they are for others.

(8) Reports from the Bureau of Navigation, Department of Commerce.

The monthly and yearly reports on American vessels documented, registered, given signal letters, and otherwise listed by the Bureau of Navigation are exceedingly helpful in developing records of our own merchant marine. Moreover, the bureau's reports on shipbuilding and losses are helpful in distinguishing private from public building, and for purging the Division's files of vessels lost through marine risk and enemy action.

(9) Telegraphic Records of Vessel Movements.

A. Cablegrams from American Consuls.

Daily cablegrams are received by the Division from certain foreign ports, and weekly cablegrams from others, giving name, flag, and principal cargo of vessels arriving from or departing for the United States. This information is significant for purpose of vessel loading and allocation, for determining the degree to which the import program is currently being met, and for providing cargoes at home and at foreign ports.

B. The Naval Communication Service.

The Navy Department, through the Naval Communication Service, secures daily by telegraph or cable, information on arrivals at and departures from American and from a number of foreign ports. This information is distributed in printed form daily, and constitutes, for operative purposes, probably the most significant single source of information on vessel movement available to the Division. The facts given include name of vessel, flag, net tonnage, dates and places of departure or arrival. Occasionally facts on cargo are also included, but these are far too meager and uncertain to serve as satisfactory data on this topic.

C. Other Cablegrams.

Cablegrams to and from the State Department, War Trade Board, Shipping Board, Division of Planning and Statistics, Division of Operations, and the Ship Control Committee serve currently to correct the files of the Division on the operative status, charter and ownership control of vessels, to indicate the types of problems that are to be solved, and to suggest statistical summaries and reports which are helpful to that end.

These sources of information and the problems upon which they bear have to do primarily with the domestic side of the shipping problem, in so far as it is handled by the Division of Planning and Statistics. There is, however, the international side which should receive attention, both as to source of material and the problems involved.

IV. THE DIVISION AND THE AMERICAN SECTION OF THE ALLIED MARITIME TRANSPORT COUNCIL.

As events have turned out, the Division of Planning and Statistics is the primary agent through which American shipping facts are furnished to the American Section of the Allied Maritime Transport Council, and to the allied nations generally as represented in the Secretariat of the Council itself. Early in the summer of this year, it became evident that the American Section of the Allied Council was not currently receiving from the United States the material that it needed to present fully the shipping situation of the United States at the meetings of the Council in London. Mr. Rublee, one of our representatives in London came to the United States in June of this year to present the case of the American Section, and it was not until the time of his visit, that the obligation of the Shipping Board to the American Section was fully realized. Domestic affairs, the newness of the work of the Division, the paucity of records, and the insistence of those at home for information all served to keep the outlook of the Division domestic. Following Mr. Rublee's visit, however, Mr. E. F. Gay, director of the Division, sent the writer to London to study the needs of the American Section as they were related to tonnage matters, to provide machinery for meeting them, to determine the ways in which the American and other sections of the Council could serve the Shipping Board, and to establish the necessary connections and the required machinery for securing these services. Later Mr. W. S. Tower of the Commodity Section of the Division was likewise sent to London to study the import and export phases of the problem.

As a result of these visits, and of the more thorough knowledge of the problems of the American Section and of the Shipping Board, a large part of the activities of the Division has been devoted to a consideration of the shipping problem in its international aspect. Information on the composition of the merchant marines of the allied, enemy and neutral countries; on movements and cargoes of allied vessels; on losses through marine risks and enemy action; on shipbuilding, repairs, salvages, charter rates, and amounts of chartered tonnage, etc., is furnished this Division by or through the American Section. Information is also supplied by the British Ministry of Shipping, the British Admiralty, and Lloyds. Some of it comes by cable, and some by embassy pouch, but it is all illuminating to the shipping problems of the world and vital in the determination of our part in them.

In supplying information on shipping problems, the Division of Planning and Statistics fully reciprocates. It sends the American Section, and through it the allied countries generally, either by cable or pouch, current data on American shipbuilding, American losses through enemy action and marine risk, repairs to American and foreign vessels, employment of American vessels and foreign vessels controlled by us, inventory facts on American Merchant Marine; required imports in long tons, and the ship tonnage necessary to move them, together with statements in detail of the types, flags, charter relations and performances of the vessels involved. These reports are by individual vessel, as well as by aggregates, and follow the forms drafted by the representatives of the Allied Council as bases for employment, and loss and gain statements.

So long as the shipping problems of the Allies are adjusted by an international council, the Division can expect to receive from and to furnish to the American and other sections of the Council current information on merchant shipping. The open, frank, give-and-take philosophy which has characterized the relations of the Council and the Shipping Board is illustrative of the unity of purpose with which nations will associate themselves for a common end. As a result of the coöperation, the American Section in London is compiling master files of American vessels (it has full access to the files of the British Ministry of Shipping, Intelligence Branch) and the Division of Planning and Shipping has built up both master and movement files on practically the entire sea-going merchant tonnage of the world. It not only has developed the machinery for efficiently prosecuting the war, but also has collected facts which, if continued, will be of value in promoting trade.

V. THE DIVISION AND OTHER GOVERNMENT DEPARTMENTS.

The coöperation of the Division with other Government Boards should be briefly mentioned. Probably the Departments with which it most fully coöperates, are the War Department and the Ship Control Committee of the board. It furnishes both organizations periodic employment statements covering American and foreign controlled vessels, and special studies of vessels suitable for use in Army service, when judged by standards of physical capacity, charter limitations, etc. A semi-monthly ship balance sheet of tonnage employed and required serves to show not only tonnage distribution, but also the nature of the excesses and deficiencies in tonnage, in trade, and in Army uses. From this statement, the Army knows currently the amount and character of tonnage in trade and is in a position to present its case for transfer of vessels to war use. Similarly, the Ship Control Committee is able to view the trade situation vessel by vessel, and as a whole, and intelligently to allocate tonnage between trades, commodities and special services.

The Division, too, has closely coöperated with the War Trade Board, in the administration of the Trading-with-the-Enemy Act, and in the collection and preparation of shipping data on foreign countries as a basis for negotiating and administering trade and shipping agreements.

VI. THE DIVISION'S ACTIVITIES ILLUSTRATED BY PERIODIC AND SPECIAL REPORTS.

The scope of the Division's activities may be further illustrated by listing a few of the many subjects covered in its statistical reports and memoranda.

1. Employment of United States vessels and foreign vessels controlled by the United States by type, form of control, by trade use and assignment.

2. Private and public charter control of foreign vessels and vessels under agreement with the Shipping Board.

3. Utilization by space and weight factors of vessels arriving and clearing foreign.

4. Merchant marine of the American and the principal foreign countries 1914 to date, showing the losses and gains by causes, trade distribution and movement.

5. Internment and seizures of enemy vessels in American and foreign ports.

6. Trade of English controlled tonnage between South America and England; between Australasia and all parts of the world, between Africa and northern Europe.

7. American coastwise vessels and commodity movement.

8. Import and export distribution of American and American controlled foreign tonnage.

9. The employment of the merchant fleets of Holland, England, etc.

10. Performance of vessels built for the Emergency Fleet Corporation.

The above reports are illustrative only, and in no way exhaust the topics upon which reports are periodically and occasionally made.

VII. THE DIVISION AS A REPOSITORY OF SHIPPING INFORMATION.

A word should be said of the Division as a repository of shipping information. The significant descriptive facts of the merchant marines of the important countries of the world are in the files of the Division. Moreover, they contain for practically all American vessels, and for foreign vessels controlled by the United States the itineraries from April 1 to date, adjusted to a graphic scale, distinguishing time in port for ports of entry and clearance, time at sea, cargo carried and space and weight utilized. Similar facts, but less complete, are available for practically the entire merchant fleet of the world, from June 1918 to date, whether trading with the United States or not. The cargo, bunker, and master's reports contain basic data for far more complete studies on turn-arounds, loading, ballast movement, port delays, etc., than it has been possible to make during the war. It is the hope of the writer that these data, which have been of distinct service in the control and utilization of our merchant fleet during the war, will be more fully utilized for the development of shipping facts vital to the peaceful prosecution of trade.

VIII. THE DIVISION IN PEACE TIMES.

Concerning the peace functions of the Division, a word is necessary.

Changes in source material and in methods will be necessary in order for the Division to retain during peace its distinctive and unique character. These changes must be made in the same thoughtful manner that was used in placing the Division on a war basis. There is room among the present trade and commerce bureaus of the Government for a Division of Planning and Statistics of the Shipping Board, but in order to guarantee against serious overlapping of function, jealousies, conflicts of jurisdiction, and waste of public money, the same readiness to adjust means to ends which has characterized the work of the Division during its year of activity must be adopted by all of the trade bureaus having to do with foreign commerce and shipping, and out of their coöperative endeavor must come a new alignment of function and duties in order to guarantee from each distinctive and unique contributions.

THE STATISTICAL WORK OF THE WAR INDUSTRIES BOARD.*

By Leo Wolman.

Administrative statistics originate in the need of executive agencies for information upon which to base administrative decisions. Where, as in the War Industries Board, administrative functions are not at the outset well defined and clearly outlined, the statistical program for such an organization must necessarily be limited in scope and irresolute and indefinite in character. To the extent to which its problems are vague, the strength of a statistical bureau is either weakened or dissipated. The organization of statistical work is, furthermore, handicapped not only where the administrative function which it serves is not clear, but also where the executive agency occupies a double capacity, and is at once both advisory and executive. A body like the Council of National Defense, whose primary function was to lend advice and counsel to agencies which themselves made administrative decisions, has in almost every case shown itself reluctant to assume the cost involved in undertaking comprehensive and continuous statistical investigations. The division of an executive function between two agencies of this kind has the weakness which characterizes all such divisions of responsibility. Whether the advisory or the administrative agency should collect the facts must generally have been in doubt, for the results of even the joint efforts of administrator and advisor are often fragmentary and unsatisfactory. Both duplication and important omission are unavoidable in the collection of statistics when there is either uncertainty or overlapping in the function of the parent agency.

I.

Of all of the war boards established by the United States Government since April, 1917, the War Industries Board has experienced the most radical and perhaps the most rapid changes in function and authority. Originally a part of the Council of National Defense, first as the General Munitions Board and later as the War Industries Board, its positive powers were few and consisted in the main in furnishing expert business advice to the great military purchasing agencies of the Government —the War and Navy Departments and the Emergency Fleet Corporation. With the tremendous increase in the military establishment in the late months of 1917, the continuing competition in the market between the various purchasing departments, the vast inroads upon supplies arising from purely military requirements, and the clear need for a systematic and comprehensive control of industry raised issues which could be met either by extending the authority of the War Department or by creating a supplementary agency with new and hitherto unexercised powers. The agitation in the winter of 1917–18 for the creation of a Ministry of Munitions, stripped of its possible political implications, constituted a recognition of the necessity for an organization which on the one hand would unify the activities of the many independent purchasing agencies and on the other would maintain an intelligent control over industry. Accordingly, on March 4, 1918, the President, in his letter designating Mr. Baruch as chairman of the War Industries Board, conferred upon that organization larger and clearer powers than it had possessed in the past. The adoption of the Overman Act on May 20, 1918, followed by an executive order separating the War Industries Board from the Council of National Defense on May 28, finally gave legal sanction to this delegation of authority.

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* Paper read at the eightieth Annual Meeting of the American Statistical Association.

As outlined by the President, the general functions of the War Industries Board were to assure an uninterrupted and adequate supply of materials for the direct and indirect military needs of this Government and of the Allies, to provide the essential civilian needs of the country, and to maintain, so far as possible, general business and industrial stability. In the performance of these functions, the War Industries Board entered into distinct and somewhat new relations with the purchasing agencies of the Government, with the public, and with industry.

(1) Little if any restriction was placed upon the power of the Government Bureaus to enter upon and to execute contracts; but the opportunities for closer coöperation with the War Industries Board were constantly extended and more and more often used.

(2) Whatever direct or indirect control over the activities of industry had in the past been exerted by the purchasing agencies fell now completely within the province of the board through its express authority, delegated to it by the President, to create new facilities, to stimulate production, to establish priorities of production and delivery, and to determine prices.

(3) Through the exercise, finally, of its powers of priority and price determination, the board was able to dictate in large measure both the character and the extent of civilian consumption and to protect the public against the rising prices that are usually the concomitants of a limited and uncertain supply of goods.

II.

Because of the close relation between the functions of the War Industries Board and those of the war and civilian purchasing bureaus of the United States Government, no satisfactory statistical program could be fashioned for either without taking into consideration the needs of both groups. Theoretically a statistical program that would meet the problems of the two groups should be easy to formulate. On the one side it is necessary to keep full and frequent statistics of supply and, on the other, complete statistics of consumption. In actual practice, however, the obstacles to this plan were serious and, in some cases, even insurmountable.

With a relatively simple material like refined copper the statistical problems were quickly solved and the results were impressive. For years before the war the United States Geological Survey had collected statistics of the annual production of copper and other metals. By prompt agreements between the producers of copper, the interested War Boards and the Survey, these annual reports were extended in September, 1917, to include weekly and monthly statistics of production and of stocks of refined copper at refineries. The War Trade Board received, similarly, current reports on stocks of copper in the hands of consumers. From the Copper Producers' Committee weekly and monthly reports were received on the allocation of copper to the various groups of consumers. And finally, the statistical inventory was made complete by the inclusion of current data on the production and stocks of the crude material or blister. On the supply side, therefore, practically all of the information necessary for making intelligent judgments was constantly available. From week to week in 1918 it was possible to determine whether the level of production was rising or falling, whether current consumption was being met from current output or was effecting heavy drafts on stocks, whether changes in the rate of output at refineries was attributable to operating conditions at refining plants or to variations in the supply of crude materials. Here, in short, were statistics which could be made to serve as the basis of an intelligent and effective control of industry.

In other fields, unfortunately, the same experience could not be duplicated. While the statistical data on the supplies of raw materials were in most instances satisfactory, the significant gaps in information were encountered in the study of fabricated goods. The reason for this difference is clear. Among such manufactured products as optical goods, machine tools, engines, machinery, the product does not finally emerge in the form of homogeneous and relatively simple units which are susceptible of statistical tabulation. The determination of the annual domestic output of machine tools, for instance, is a task of immense detail and magnitude. Even in peace times, accordingly, statisticians depended for their indices of changes in the national product almost wholly upon the statistics of the output of raw materials. The difficulties during the war, therefore, were twofold. In the first place, the lack of past statistical material made practically impossible any comparative studies of output; and in the second place, the complexity of the material rendered impracticable an adequate survey of the field during the present. In spite of these obstacles, however, the activities of the War Boards in these fields of industrial statistics have made available for the students of economics a body of data far superior, in adequacy and accuracy, to such information as was found, for instance, in the quinquennial reports of the Census of Manufactures. Where, furthermore, direct measures of output were unobtainable, surveys of factory capacity and of the number of wage-earners, interpreted by men familiar with industrial technic, have constituted excellent indirect measures of the size of the product.

The body of statistics relating to the consumption of raw materials in this country was even more meager than the statistics of the output of fabricated goods. Except for some scattered information in the Bureau of the Census, the Geological Survey, the Forest Service, and the Bureau of Markets, this field was barren. The urgent need for even incomplete statistics of consumption was also clear. In the case of almost every important basic material, imported or produced in this country, curtailment of consumption became, either early or late in the war, necessary. A program of curtailment presupposes a knowledge of the places in industry where economy is possible and, if possible, desirable. Such knowledge can rest only upon data which would indicate, first, the indispensable military consumption of the material and, second, the total civilian consumption, classified into consumption for various purposes and arranged in their order of importance.

During the second year of the war, for instance, a shortage of mercury was threatened. The gradual development of the shortage made necessary the curtailment of certain forms of civilian consumption of this material. The Non-Ferrous Metals Section of the War Industries Board, therefore, began the collection of figures on the military and civilian consumption of mercury. On the basis of this study it was possible to construct a table showing, first, the estimated military consumption of quicksilver in the form of mercuric fulminate and drugs and chemicals, and, second, the normal amount consumed by civilian industry in the production of such diverse products as drugs, electric batteries, dental amalgams, cosmetics, automatic sprinklers, vermilion, and felt. Once these data were available and curtailment proceeded by a progressive restriction of dispensable civilian consumption as the military requirements became larger and more pressing. The problem in this instance was a typical one. And gradually, either by a direct circularizing of the industry or through the medium of the United States Bureau of the Census and Trade Associations, like the Rubber Association of America and the Producers of Naval Stores, a vast body of significant material on the statistics of consumption was collected.

While the gathering of the statistics of general civilian consumption fell within the province of the War Industries Board, estimates of direct and indirect military needs and consumption were contributed by the several purchasing agencies of the Government. This task was, of course, entirely new. Its successful execution depended upon the organization of a central statistical bureau in the War Department whose function it would be to standardize military requirements and to submit them to the War Industries Board in the form of frequent reports. Similar arrangements could be made with the other great purchasing bureaus. If this had been done, the War Industries Board would have had the material necessary to supplement the statistics of supply and civilian consumption. It was not, however, until the summer of 1918 that the preliminary steps for unifying requirement statistics in the War Department were taken with the institution of a statistical organization as part of the Division of Purchase, Storage, and Traffic of the General Staff. This system was a marked improvement over the old. Instead of receiving four different requirement schedules from each of the great branches of the Army, every schedule characterized by peculiarities of its own and constructed in accordance with no uniform plan or set of instructions, some standardization was finally effected. While, of course, it was impossible to combine likewise the requirement divisions of purchasing agents outside the Army, the fact that the Army was in most cases the largest single purchaser made an improvement in its statistical apparatus a material step in advance.

Many of the problems concerned with the statistics of military requirements could not, however, be solved by formal changes in the organization of the statistical branches of the purchasing bureaus. The weakness of requirement statistics to the very end was due to the failure to clarify fundamental concepts. In reality the military consumption program of the country consisted of two elements. The first was a statement of a theoretical purchasing program, extending a year or even two in the future, and may be called the requirement program. The second consisted in a schedule of actual current contracts or purchases. The one represented roughly a projected and the other an actual consumption graph. The requirement schedules of the War and other departments were rarely of great utility, primarily because of the wide range of interpretations that were placed upon the term "requirements." A schedule of requirements for explosives, for example, was based upon the maximum attainable capacity, within a specified period, of the explosives plants of the country, irrespective, in some instances, of the availability of a sufficient supply of raw materials for the full employment of this capacity. Requirement schedules of the Signal Corps, on the other hand, rested apparently upon the needs of the Army and the quantities required were often far in excess of any present or even future visible supply. In still other cases, the requirement schedule was merely a projected contract schedule in which various modifying factors were used to allow for possible changes in the rate of purchase.

While, from its very nature, the contract or purchase schedule was a more exact piece of statistical material than the schedule of requirements, its availability and utility was also limited. In spite of frequent efforts to centralize information on war contracts, the job was never accomplished, with the inevitable result that the essential statistical combinations and comparisons could not be made. It should be noted, however, that in the construction of either a requirement or contract schedule a fundamental difficulty was always present. Both were functions of the extent of the military program. The influence upon the military program of changing political and military factors was, of course, great. There resided, consequently, in any estimate of military needs, a large element of conjecture which it was not easy to eliminate. It is reasonable to assume, however, that the institution of a planning or statistical bureau in anticipation of the war or immediately after its outbreak would have helped to avoid many of the statistical pitfalls which the executive or administrative organs later met.

III.

In actual operation the statistical divisions of the War Industries Board ran the whole gamut of experiences, from periods of monotonous quiet and inaction to stages of energy and bustle. During the period preceding the separation of the War Industries Board from the Council of National Defense, the relation between the statistical division of the Council and the Board was not an intimate one. The major part of the work done by the statistical division, consisting in graphic reports to the War Department on the status of procurement, was not directly in response to the peculiar needs of the War Industries Board. Later, however, with the development of sections on the statistics of raw materials, on the organization and problems of War Industries abroad, and on Government contracts, the statistical service to the Board became more extensive. The inherent difficulty, of course, in meeting the statistical needs of the War Industries Board at this stage of its development consisted in the fact that its functions were still vague and its needs, therefore, not clear. Whatever statistical material was collected was, consequently, dictated rather by anticipated future needs than by present requests for information.

In the early spring of 1918, the first clear differentiation between the statistical work for the War Department and that for the Council and the War Industries Board was drawn when part of the organization was moved to the War Department to become the Statistics Branch of the General Staff and the other part remained as the statistical division of the Council. When the formal division of the Board from Council of National Defense took place, the statistical division became a part of the War Industries Board. Throughout this stage of transition, the many uncertainties of the situation made impossible any large development of the statistical organization. In June, however, the reorganization of statistical work with the creation of the Division of Planning and Statistics of the War Industries Board marked the beginning of a new and more fruitful stage in the statistical organization of that agency.

The unit of organization in the War Industries was the Commodity Section. The chief of each section was practically in complete control over the factors affecting the supply of the commodity or group of commodities which were under the jurisdiction of his section. The chief of the steel section, for instance, was practically the public manager of the iron and steel industry of this country. The first and most important task of the statistical division, therefore, was the organization of an adequate statistical office for each of these commodity sections. This was done by placing representatives of the Division of Planning and Statistics in practically all of the more important sections. The functions of these representatives were twofold and consisted first in making provisions for the collection and presentation of statistics to the chief of the section and, second, in submitting to the director of the Division of Planning and Statistics, current critical reports on any aspects of supply and requirements which, in the judgment of the commodity statistician, needed comment. On the basis of these statements a general report on the operations of the Board as a whole was prepared by the Statistical Division for the use of the chairman of the Board. Although this system was not in effect for a very long time, its results in the form of more extensive and more dependable information were noteworthy.

A second section of the Division of Planning and Statistics was concerned with the collection and interpretation of price statistics. Originally a part of the statistical division of the Shipping Board, its principal function had been to furnish price material to the commodity experts of that division for their use in noting the probable effects of import restrictions on prices in this country. With the transfer of the Price Section to the War Industries Board, its usefulness was extended and its program became more ambitious and elaborate. It established primarily an intimate contact with the Price-Fixing Committee of the War Industries Board by supplying to that body detailed studies on the movements of prices. Prior to this, the Price-Fixing Committee had relied for the determination of fixed prices upon the cost data of the Federal Trade Commission. With the institution of the Price Section, it became possible for the committee to supplement the cost information with detailed inquiries into the movement of specific prices from 1913 to the current month. The economic and statistical by-product of the work of this section is to be found in the accumulation of a vast fund of price material, differing from other collections in the extent of price quotations on fabricated goods and in the possession of both quoted and contract prices.

Already the activities of the members of this section have been turned to excellent account by the issue of such bulletins as "The Movement of Prices during the Civil War and the Present War" and "The Fluctuations of Controlled and Uncontrolled Prices," in addition to many reports on price changes in the materials and products of particular industries. Comparative studies on price movements in England, France, and Italy are now in progress. Fortunately, also, the Price Section has been designated to continue its statistical analysis of the price system and contemplates the preparation within the next six months of an exhaustive history of price movements in the United States during the war.

Of the remaining sections, the Contract and Editorial, only the first was designed to make positive additions to the statistical material of the War Industries Board. As early as August, 1917, the Statistical Division of the Council of National Defense was authorized to obtain from Government contractors current reports of the progress on war contracts. A start was made on building up a contract file and schedules were currently sent to a large number of contractors. The task was, however, a formidable one and could have been properly handled only by a statistical staff as large as that of the Bureau of the Census. While the work in the contract section was not allowed to lapse completely, little attempt was made to extend its scope and the information was always too incomplete to be useful. This gap in material was serious both because of the practical impossibility of making satisfactory surveys of Government contracts during the war and because of the complete lack of data upon which, after the signing of the armistice, it was essential to base a reasonable program of contract cancellation.

The function of the Editorial Section was principally to make available to other war agencies detailed statements of the status of the supply program and of the influence upon this program of industrial conditions. Accordingly, a series of monthly commodity bulletins, covering those materials of which there was either an actual or impending shortage, were issued to more than two hundred Government officers. In addition, moreover, to these four sections, the Division of Planning and Statistics included a staff of research men who were engaged in the study of special problems for the use either of the War Industries Board or of related agencies. This group completed a series of informing studies on the effects of curtailment orders on industry, the availability of factory facilities in the United States, war-time industrial organization and problems abroad, and the consumption of materials in non-essential industries.

Although the statistical work of the War Industries Board was concerned with a distinct set of problems arising from the problems of the Board itself, opportunity for coöperation with the statistical agents of the War Boards and of the permanent departments was frequently afforded. Even before the organization of the Central Bureau of Planning and Statistics, a close informal union existed between the statistical divisions of the Shipping Board, the War Trade Board, and the War Industries Board.

As this bond was strengthened, a loose division of labor was effected in which the responsibility for statistics of imports was placed upon the Shipping Board, of exports on the War Trade Board, and of domestic industry on the War Industries Board. In some instances the joint effort was formalized by the organization of joint statistical offices, like the Joint Committee on Leather Statistics, or where the statistics branch of the Army and Navy was included, like the Joint Office on Chemical Statistics.

In the same way, coöperative arrangements made accessible to the War Industries the accumulated material of the permanent Government departments. It is, indeed, no exaggeration to state that, without the information and the advice of the technical experts of such Government agencies as the

Geological Survey, the Bureau of Mines, the Forest Service, the Bureau of Markets, and the Bureau of the Census, a large part of the fundamental factual material relating to the raw material resources of the country would never have been collected. Although unable to extend their own statistical activities because of the lack of funds and the pressure of their normal duties, these departments furnished the foundation upon which the War Boards were able to construct their statistical edifices.

IV.

The story of the organization and collection of statistics for the War Industries Board is a chronicle of substantial accomplishment in the face of serious obstacles. Whatever weakness was present in the statistical organization of the War Boards is obviously attributable not to their personnel but to their organization. It is clear, in the first place, that the collection of statistics should have been preceded by the formulation of a comprehensive plan, which would have canvassed thoroughly all possible statistical needs of a country at war and would have made provision for them. It was a mistake, further, to provide for a statistical unit which is not an integral part of the administrative body which it is designed to serve. For a long time, the statistical division of the War Industries Board was almost as foreign to that agency as were, for instance, the statistical divisions of the Shipping Board or of the War Trade Board. Intelligent collection of statistics presupposes a knowledge of problems, and such a knowledge can be obtained only if one has entry into the council of the elect. Difficulties, such as the supposed reluctance of men of affairs to receive information and advice from professional statisticians and the necessity for making decisions with such rapidity that there was no time to consult the statistics, were after all only of minor significance. What was really lacking was, first, a preliminary plan broad enough to encompass the general statistical requirements of the Government and, second, the amalgamation of the statistical bureaus with the agencies of which they were ostensibly a part.

Whatever the limitations, however, the work was for the most part well done. The scientific by-product of the work of the Statistical Division of the War Industries is represented by a wealth of statistical material bearing on the fundamental problems of American industry. In the fields of production and price statistics, and in the data relating to the distribution and consumption of the physical product of the country, the collection is perhaps unparalleled. The files of the Division of Planning and Statistics and of the Commodity Sections of the War Industries Board may, indeed, serve as the origin for a series of studies which should for the first time combine inquiries into the nature of technologic and economic factors in industry. The immediate task for this scientific fraternity is, therefore, to provide for the preservation of the records and for their easy accessibility to the students of science.

THE STATISTICAL WORK OF THE WAR TRADE BOARD.*

By ARTHUR E. SWANSON.

Statistical material is secured by the War Trade Board partly in the form of records needed chiefly in the administration of individual transactions, partly as a by-product of administration, and partly in the form of data collected for purposes of statistical control.

To illustrate the first kind, an exporter of coal must accompany his application for an export license with a supplemental information sheet giving a number of details which serve to guide the trade adviser in the Bureau of Exports in deciding whether that particular license should be granted. In this instance the data are secured to aid in the administration of individual transactions.

It would be possible to prepare from these supplemental information sheets, statistical reports of value as a by-product of administration. They would show the monthly and annual consumption of fuel by various industries in foreign countries; the amount of coal at various points of destination on stated dates; the number of tons of coal in transit at given periods and the amount of coal shipped by districts of origin by months or some other period.

The third kind is illustrated by the export declarations which are required, not primarily for the purpose of checking individual declarations against a license, although that is done, but chiefly in order to secure data for the compilation of reports to show the amounts and value of different commodities exported.

Only a portion of the material assembled by the various Bureaus of the War Trade Board accordingly is handled in a way which we normally think of as statistical. The remainder is handled as records, a study of which frequently proves helpful though no statistical compilation is made.

The character of the statistical material assembled by the

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*Paper read at the eightieth Annual Meeting of The American Statistical Association.

War Trade Board can be best understood in the light of the functions of the War Trade Board, because the material is assembled either for the purpose of aiding in the execution of these functions or as by-products of them. It will be helpful accordingly to discuss briefly some of the more important of these functions.

The War Trade Board, which is a successor to the Exports Administrative Board established August 21, 1917, was created by executive order October 12, 1917. By this order the Board was vested with the power and authority to issue or refuse licenses for the importation and exportation of articles the trade in which was restricted by proclamations issued before or after the establishment of the Board, and to issue or refuse licenses to trade either directly or indirectly with the enemy. As a result, the Board, through the executive order and subsequent proclamations, has been given very wide controlling power over the foreign trade of the United States. Through this control it has sought (1) to reduce to a minimum the shipments of goods through neutral to enemy countries, (2) the elimination of any direct trade with the enemy, (3) the reduction to a minimum of trade with pro-enemy persons, or firms, in neutral countries, (4) the conservation of materials needed for war purposes by refusal to allow the exportation thereof, (5) the facilitation of the exportation of certain commodities required in neutral countries because of their direct or indirect aid in the war, (6) the facilitation of the exportation of certain commodities to allied countries, (7) the restriction of importation of commodities in order to conserve tonnage, (8) the control of the movement of vessels through bunker licensing.

The Board is organized for the performance of its functions into Bureaus as follows:

Bureau of Exports
Bureau of Imports
Bureau of War Trade Intelligence
Bureau of Transportation
Bureau of Research and Statistics
Bureau of Foreign Agents
Bureau of Enemy Trade

Bureau of Branches and Customs
Bureau of Administration

The Bureau of Research and Statistics is a combination of the Bureau of Tabulation and Statistics and the Bureau of Research which functioned separately until very recently.

Briefly summarized, the Bureau of Exports receives the applications for export licenses, grants or refuses them, according to rulings of the War Trade Board and the findings of the Bureau of War Trade Intelligence.

The Bureau of Imports functions similarly for imports.

The Bureau of War Trade Intelligence is charged with securing information which will prevent trading with the enemy and issues its instructions to the Bureaus of Imports and Exports.

The Bureau of Transportation controls the movement of vessels bunkering at ports of the United States.

The Bureau of Research and Statistics undertakes economic and political investigations assigned to it by the Board and tabulates statistical material for the Board and for the various bureaus.

The Bureau of Foreign Agents is the home office for the agents and representatives of the War Trade Board in foreign countries.

The Bureau of Enemy Trade passes on the licenses to trade with the enemy.

The Bureau of Branches and Customs is the home office of the branch bureaus of the War Trade Board throughout the United States.

The Bureau of Administration is, as the name indicates, the administrative bureau of the Board.

Although this plan provides for the concentration of the statistical work in one department, considerable statistical work has had to be performed by the other Bureaus.

IMPORTS INTO THE UNITED STATES.

In order that the War Trade Board may be in a position to grant or to refuse the license, the importer is required to submit with his application for a license a statement containing specified information as follows:

Date
Applicant's reference number
Applicant
Consignee
Actual purchaser
Number and kind of packages
Net weight (in pounds)
Consignor
Country in which purchased
Country in which produced
Producer
Port of shipment
Port of entry

After this application has been granted or refused by the Bureau of Imports, the Bureau of Research and Statistics tabulates these data to show the amount in value and quantity licensed for import by ten-day and monthly periods and by countries of origin. It also tabulates in a similar manner the licenses refused.

It would be possible to tabulate likewise the imports for which licenses are granted or refused by port of shipment, port of entry and by country of production, but this has not been done due to the amount of time and labor involved.

The value of the tabulation of commodities licensed for import is significant in many instances, but is impaired by the fact that many licenses are not utilized but permitted to expire unused and that licenses are frequently cancelled by order of the War Trade Board for various reasons.

The particular value of the tabulations of commodities licensed for import has been the indication these tabulations have given as to the amounts of the various commodities which importers plan to bring into the country. The tabulations have not given exact information of this kind because of the large number of cancellations and revocations.

Upon receipt of his license the importer submits it to the collector of customs for entry as to date of entries, number of vessels or cars, quantity and value. With it he submits a consumption entry in duplicate with information as to

Port
Entry filed
Consignee
Date of arrival
From
Marks and numbers
Merchandise: packages and description
Quantity
Value in foreign money
Value in United States money
War Trade Board commodity code number
War Trade Board license number
Invoice number
Date
Place

One copy of the consumption entry is forwarded to the Bureau of Research and Statistics for tabulation.

These entries are in the form of consumption entries, appraisement and informal entries, warehouse and re-warehouse entries, warehouse and transportation entries, in-transit entries, and carriers customs manifests. The data on these entries are tabulated to show the imports of commodities, in quantity and value, by country of origin.

EXPORTS FROM THE UNITED STATES.

To obtain an export license the consignor must submit an application blank to the Bureau of Exports, or to a collector of customs, in case of a small shipment of non-conserved commodity not over one hundred dollars in value, when sold to a consignee not on the enemy trading list and not in enemy or pro-enemy countries. The data given include

Date
Applicant's reference number
Consignor
Approximate number and kind of packages
Commodity
Weight
Value of each item
Consignee abroad
Ultimate destination

If the application is granted, the exporter is given a license containing the information as follows:

Date
Expiration date
Applicant's number
License number
Consignor
Approximate number and kind of packages
Commodity
Quantity
W. T. B. code number
Value
Consignee
At
Ultimate destination

The data on the export licenses are tabulated to show the commodities, in quantity and value, licensed for exportation by countries of destination. The tabulations of the export licenses indicate in a broad way the amount of goods the exporters are planning to ship out of the country but, as in the case of import licenses, such tabulations do not give accurate information because of cancellations, expiration of the licenses and revocations. License refusals are also received by the Bureau of Research and Statistics, coded, recorded, filed. When the goods are shipped, the Bureau of Research and Statistics receives a copy of the shippers' export declaration containing the following information:

Consignor
Place of original shipment
Carrier or vessel
Port of exportation
Ultimate destination
W. T. B. export license number
Date of expiration
Marks and numbers
Number and kind of packages
Commodity
W. T. B. code number
Quantity
Value

These data are tabulated to show the actual exports, in quantity and value, by country of destination.

One object in tabulating the actual imports and exports, as well as the licenses for imports and exports, was to check the actual imports and exports against those licensed so as to ascertain whether the actual imports or exports exceed the amounts licensed. Though this check has been valuable it has not been exact because of the large number of cancellations, revocations and expired, unused licenses.

Another purpose in arranging the tabulating procedure was to so file the Hollerith cards used for a license and for an actual export or import that they could be readily compared and violations detected. This procedure, although provided for, has not been developed fully and the checking for each import or export shipment has been accomplished in the main by comparing the original license with the import entry or the export declaration.

The tabulation of actual imports and exports is in a measure a duplication of the tabulation by the Treasury Department and the Department of Commerce, but this duplication was unavoidable without a substantial modification of the commerce classification which it was inexpedient to make except upon considerable study.

It was essential that a classification be devised which suited the purposes of the War Trade Board. It was also necessary to have the imports and exports given in weight in each instance as well as in value.

As an illustration of the reports that are prepared, the data relating to export licenses are tabulated as follows:

A general tabulation of export licenses granted is prepared by ten-day periods, for forty-three (43) country groups. This tabulation is for quantities only. The commodities in the classification have been selected because significant amounts of them are ordinarily exported by the United States. Each month a summarized tabulation is prepared for ten groupings of commodities totaled for each of the forty-three country groups.

In addition to this general report on export licenses granted the Bureau prepares at regular intervals (daily, weekly, or monthly) certain reports which apply to a specific country, or to a specific commodity or group of commodities. The following are examples of such reports:

1. Daily tabulation of licenses granted for export of food stuffs.

2. Daily tabulation in detail of every item of information contained in the export licenses for all licenses granted to Mexico.

3. Monthly tabulation of licenses for shipments having a value of less than one hundred dollars.

4. Monthly tabulation of licenses granted to the Northern Neutrals. Likewise, monthly tabulation of licenses granted to the United Kingdom, Japan, Italy, France, Dutch East Indies, Belgium and Argentine.

5. Ten-day tabulation of licenses granted for export of sugar. Similar ten-day report on rubber and manufactures thereof, pig iron, oil, flour substitutes, etc.

6. Monthly licenses granted and refused to Greece giving quantity, value and number of licenses.

Most of the above reports are for quantities, values, and number of licenses.

In addition to the above regular reports, both general and specific, the Bureau prepares a large number of special reports, when requested by officers of the War Trade Board and other Governmental agencies.

The import licenses granted are tabulated by calendar months for the same forty-three (43) country groups and for the same commodities for which the export licenses are tabulated. As the commodity classification used for the tabulation of import licenses was prepared primarily for the classification of export licenses, it contains many commodities which we do not import, and on the other hand does not contain a number of commodities of which we import a substantial amount.

In addition to the general tabulation the monthly tabulations are prepared for specific countries and commodities, as in the case of exports.

Similarly, for actual imports and exports, general and specific reports are prepared regularly daily, by ten-day periods, or monthly, and special reports are prepared as requested.

TRANSPORTATION.

Data pertaining to vessels bunkering in Ports of the United States are received by the Bureau of Transportation in regard to

1. General characteristics and equipment of vessels
    - a. Type of vessel
    - b. Tonnage
        - Gross
        - Net
        - Deadweight
    - c. Number of officers
    - d. Number of crew
    - e. Type of engines
    - f. Indicated horsepower
    - g. Average daily consumption of fuel
        - at sea
        - in port
    - h. Average speed
2. Registry, ownership and control of vessels
    - a. Flag
    - b. Owner
        - Nationality
        - Address
    - c. Charterer
        - Nationality
        - Address
    - d. Charter party
        - Date
        - If time charter
            - date of expiration
            - trading limit
3. Bunkers for vessels
    - a. Fuel taken aboard
        - (1) At American ports
        - (2) At foreign ports
    - b. Stores and supplies taken aboard at American ports
        - Food
        - Deck and cabin supplies
        - Engine supplies

The above records are complete only for a brief period as bunker control did not commence until February, 1918.

Specifically, the information under (1) is generally complete except for statement of deadweight tonnage of vessels. Under (2) the charter facts are not always given, this being largely a question whether the vessel is under control of the Chartering Committee of the United States Shipping Board. Under (3) the record of fuel taken at American ports is complete. The "Master's Report on Outward Voyage," which contains the record of fuel taken at foreign ports, has been required for the last few months only, and in some cases has not been submitted. Likewise the records of stores and supplies taken aboard at American ports only now begin to come in a reasonably complete form.

The following are the documents known as bunker forms from which these data are secured:

Application for license, bunker fuel, port, sea and ships stores and supplies.
License for bunkers and stores.
Master's report on outward voyage.
Agreement to comply with bunker rules.
Agreement that vessel will return to United States for discharge of entire return cargo.
Agreement to return.
Agreement of master of vessel regarding discharge or transfer of bunkers and stores and filing of bunkers and stores licenses.
Affidavit and agreement of master of vessels governing disposition of cargo.
Preliminary license for bunkers and stores. (Not used.)
Food store list.
Deck and cabin store list.
Engine store list.
Slop chest list.
Supplementary stores list.
Food consumption report.
Stores for vessels lying in the stream.
Application for sugar purchase.

Individual allied seaman's application for food supplies for home consumption and personal effects.

Summary of allied seaman's application for food supplies for home consumption and personal effects.

Reports of various kinds have been prepared through the tabulation of these data but in the main the records have been used individually and not statistically.

INFORMATION RELATING TO THE ECONOMIC CONDITIONS AND TRADE OF THE UNITED STATES AND FOREIGN COUNTRIES.

The data bearing on the trade and economic conditions of the United States and foreign countries have been obtained chiefly from the official reports of the countries in question. The Bureau of Research and Statistics, in addition to a large number of official publications which it has been able to secure, has utilized very freely the publications in the Congressional Library, the Library of the Department of Commerce and the Library of the State Department. The official sources have been supplemented by a very large number of reports in the form of cables and written communications from embassies and consulates, War Trade Board representatives and agents, Military Intelligence Agents, Naval Intelligence Agents, the Shipping Board Mission, and attachés of the Department of Commerce. A large number of inquiries in particular have been addressed to representatives and agents of the War Trade Board.

Early in the year a special questionnaire was submitted by the State Department to all consuls. This questionnaire was particularly designed to secure information for the "Inquiry" but copies of all the reports were made available to the Bureau of Research and Statistics. A special questionnaire was prepared jointly by the State Department and the Bureau of Research and Statistics which was to serve as a basis of a monthly report by each consul. This questionnaire with instructions was sent to all the consuls, and reports are soon due. It is very important that these monthly reports be continued. If they are, and if the consular offices are so equipped that they can prepare reports based on these questionnaires, we shall be receiving in this country excellent data on the trade and economic conditions of foreign countries.

The following list of reports prepared indicates the nature and the extent of the investigations made:

1. Reports showing the quantity of essential imports into neutral and allied countries from the United States prepared in order to enable the War Trade Board to establish export priorities and in order to reduce the exports to a minimum, thereby releasing tonnage for war use. These studies have been most comprehensive and have been designed to show the quantities of such imports not only in totals but classified according to the amounts required by the importing country in order to assist it in contributing to the successful prosecution of the war and to show the amounts required by the country for its own economic life.

2. Exhaustive studies of the economic position of certain neutral countries particularly those contiguous to enemy countries in anticipation of agreements between the United States and those countries for the purpose of controlling, if not eliminating, their trade with the enemy.

These researches have been made to ascertain the essential requirements of these countries for home consumption, their ability to produce goods to meet these requirements, their dependence on enemy countries for essential requirements, our ability, or that of our Allies, to reduce or eliminate this dependency and, if such dependency could not be removed, the economic compensations which these countries would be required to make to the enemy countries.

To illustrate, it has been necessary to determine the exact amount of the various foods produced in a number of countries and to determine, on the basis of accepted rations, the exact amount consumed so as to ascertain the amounts of food of the various kinds that had to be imported and the time of the year when these imports must take place.

3. Investigations of the economic position of certain countries designed to show in what capacity and to what extent those countries, even when neutral, could contribute to the successful prosecution of the war through a more intensive utilization of their resources.

4. Commodity studies to show the world requirements for specific commodities for a year in advance and comparisons of these estimated amounts with the estimates of production.

5. The effect of the war on the foreign trade of allied nations, particularly the United Kingdom, in order to show to what extent the foreign trade was reduced or modified by the war. So many varied opinions prevailed regarding the effect of the war on the foreign trade of the United Kingdom,—many persons intimating that the United Kingdom was not allowing its foreign trade to be greatly handicapped by the war,—that it was desirable to have a careful study made of the actual situation.

6. Reports on the accumulated shortages and surpluses of key commodities in specified countries.

7. Investigations to determine whether the demand for certain commodities for war uses in relation to the supply was such as to warrant the placing of that commodity on the conservation list of the War Trade Board.

8. A study of the net balance of trade, shipping and insurance accounts between the United States and thirteen foreign countries. The purpose of this study was to assist the Treasury Department in determining where and to what extent credits should be extended to foreign countries.

9. Investigations to show the distribution of the imports of specific commodities amongst importers and manufacturers for a selected year in order to determine the relative amounts of the restricted imports of these commodities which should be allocated to each importer and manufacturer.

10. Similar investigations were made in the case of commodities the export of which was restricted, except that in this case the studies were made of the amounts exported by the consignors in this country, or amounts imported by the consignees in such countries where the restriction applied.

11. Studies conducted jointly with the Food Administration, the Shipping Board, the War Industries Board to show by countries the net imports or net exports of specified commodities, thereby indicating the position of each country in relation to that commodity.

SPECIAL INQUIRIES.

From time to time the Bureaus of Imports and of Exports in particular and sometimes other Bureaus have sent out special questionnaires, either directly or through trade associations. A large number of questionnaires have been sent out in this manner. The information gathered in this way has been tabulated sometimes by the trade associations, sometimes by the Bureaus securing the questionnaires and sometimes by the Bureau of Research and Statistics.

The object in securing the information sought by these questionnaires has varied. In a large number of instances the purpose has been to aid in the allocation of the commodities imported amongst the various importers in accordance with some equitable plan or to allocate the amounts exported among consignors or consignees.

In a large number of other instances, the object in securing this information has been to ascertain the use to which the commodity will be put in the country of destination and thereby help the Bureau of Exports to determine whether the commodities should be allowed to leave the country.

THE CENTRAL BUREAU OF PLANNING AND STATISTICS.*

By Z. L. POTTER.

When I undertook to tell the story of the work of the Central Bureau of Planning and Statistics I discovered that a very clear statement of it had been prepared by Mr. F. B. McLeary, a member of the staff of the Bureau. I therefore endeavored to persuade Mr. McLeary to take my place on the program. This he was unable to do but he gave me permission to use his paper in whole or in part. I have taken advantage of his offer to utilize it practically in its entirety, and he should be given the greater part of the credit.

The Central Bureau of Planning and Statistics came into existence early in June of 1918 for the express purpose of preparing for the attention of the President a "Conspectus of all the Present War Activities of the Government" on which conspectus could be based a "Periodic checking up of actual operations and results."

The passages quoted are from a letter written by the President to Mr. Bernard Baruch, chairman of the War Industries Board, under date of May 24, 1918. Pursuant to the recommendation embodied in this letter, Mr. Baruch authorized Mr. E. F. Gay to gather together a group of men to secure from various governmental agencies weekly and monthly "Progress Reports" and to prepare, primarily on the basis of these reports, authoritative surveys of the work accomplished toward the effective conduct of the war.

In order to perform these functions it was found necessary to make a survey of the statistical information available in the various governmental departments. This survey—made in July, 1918—disclosed the fact that in the gathering and compiling of statistical data there was very considerable duplication.

The industries of the country were being burdened with the answering of innumerable questionnaires, many of which sought information of a character necessitating a vast amount of clerical labor and the interruption of highly important work. Moreover, the same questions addressed to the same firms and individuals would frequently appear in a number of different questionnaires, and questionnaires would be sent out by one government agency in quest of information that had already been compiled and brought up to the minute by another.

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*Paper read at the eightieth Annual Meeting of the American Statistical Association.

Need of a statistical clearing house was both obvious and imperative. By reason of the contacts which the Central Bureau had already established with the Division of Planning and Statistics of the United States Shipping Board, with the Bureau of Research of the War Trade Board, with the Division of Planning and Statistics of the War Industries Board, and with the Statistical Committee of the War Labor Policies Board, through the fact that these agencies were all reporting to Mr. Gay, the Central Bureau of Planning and Statistics appeared to be the logical agency for revising and consolidating the questionnaires going out under governmental authority and for building up an accessible index to all statistical data gathered by governmental and quasi-governmental agencies.

The program of the Central Bureau, therefore, expanded to include not only (1) The preparation of a periodic survey or conspectus of all the war activities of the Government, but also and incidental to the preparation of such a survey; (2) The organization and maintenance of a clearing house of statistical information.

The staff of the Central Bureau of Planning and Statistics on October 5 numbered about 63 members, 28 of whom were experts made up in about equal proportions of statisticians and economists and business men. The staff, between July and December 21 included the following specialists under definite assignment:

E. F. Gay, Director
H. S. Dennison, Assistant Director

Name	*Assignment*
A. N. Holcombe	Conspectus of Special War Activities
E. E. Day	Statistical Audit
Z. L. Potter	Statistical Clearing House
V. E. Parmenter	" " "
R. C. Routseng	" " "
F. W. Jenkins	" " "
C. W. Doten	" " "

Name	*Assignment*
E. J. Frost	War Department
L. D. Gibbs	" "
R. C. Hay	" "
H. M. Goddard	" "
R. S. Hale	" "
W. S. Rossiter	Navy Department
F. L. Lamson	Labor Department
F. G. Bates	" "
R. S. Marshall	Railroad Administration
J. W. Carmalt	" "
J. E. Downey V. C. Finch F. A. Roper	Food Administration and Department of Agriculture
Eliot Jones	Fuel Administration
F. R. Wadleigh	" "
C. S. Whittier	Emergency Fleet Corporation
F. B. McLeary	War Trade Board
H. M. Bates	Special Studies
F. T. Kurt	" "
J. V. Hall	" "

I. DEVELOPMENT OF THE CONSPECTUS.

Conspectus of War Activities:

The first step in picturing the various war activities of the United States was to analyze and classify these activities and to indicate the respective agencies charged with their administration. In accordance with this plan a printed "Conspectus of Special War Activities" was issued August 14, 1918, and a supplementary report September 11, 1918. In connection with this work an indexed Digest of the Federal Administrative

Agencies was also prepared. This Digest has been revised from time to time and now gives an accurate and complete view of the administrative organization of the Government.

Weekly and Monthly Surveys:

For the purpose of facilitating the preparation of weekly and monthly surveys and special reports covering the various war activities of the Government, a division of the Central Bureau designated as the Statistical Audit, was early created, which division became responsible for the standardizing of graphic methods and the working out of innumerable statistical and mechanical details for the Central Bureau reports.

Army:

The information contained in the first Army survey for the week ending July 26, 1918, represented a summary of certain data contained in the weekly statistical report of the War Department, and in this and subsequent surveys attention was particularly directed to such portions of the Army program as seemed in need of redoubled concentration of effort.

Since the issuance of the first weekly report on the Army program, the Central Bureau has constantly striven to clarify the data presented and to broaden their scope; and in working towards these ends the Bureau, it is believed, has performed a very definite service.

The most recent Army report, its character changed to accord with conditions following the armistice, comprises 21 pages, as against 6 pages in its report of July 26. The data contained therein show, among other things, cancellations of contracts by geographical sections to November 30th, stocks of military equipment and ammunition on hand at November 15th, reserves on hand in the Chemical Warfare Department, the status of aircraft production under contracts placed both here and abroad, the situation with regard to goods on order for the Signal Corps, the total number of American Service Squadrons at the front and the number equipped with American planes, estimated reductions in expenditures for motor vehicles, the total value of all clothing and equipage on hand November 1st, appropriations and expenditures to November 5 for construction work at the various training camps, the situation with regard to American locomotives overseas and on order, stocks of medical supplies on hand at November 1st, a complete summary of casualties reported up to November 26th and the status of the Army as regards demobilization.

Navy:

Four monthly surveys of the Navy Department have been prepared by the Central Bureau. This work has been facilitated by the friendly interest and coöperation manifested by the various chiefs of the department from whom it has been necessary to secure the requisite data; and as a definite result the Navy Department is arranging regularly to provide the Central Bureau with such information as will make possible the preparation of accurate and comprehensive surveys of the Navy Department, these surveys to be submitted, through the Central Bureau, to the Chief Executive.

Labor Department:

A report on the activities of the Department of Labor has been prepared, showing in particular the organization, functions and activities of the special war agencies created at the request of the President, January 4, 1918.

In coöperation with the Division of Planning and Statistics of the War Industries Board and the United States Employment Service, a weekly survey of labor conditions in one hundred and twenty industrial centers of the United States is now being conducted by telegraph.

Railroad Administration:

Three major reports on the railroad situation have been prepared by the Central Bureau, in which have been analyzed the revenues, expenses, railway operating income and freight train operation of the railroads under federal control. In addition a study has been made of the export freight situation at North Atlantic and Gulf ports as of November 21st, and a report has been prepared showing the freight on hand at the ports and the volume of movement to the ports. Arrangements have been made for the submittal of weekly reports on this situation. A special study has also been made of the coal car supply at the mines and the methods employed for equalizing supply and demand.

Department of Agriculture and Food Administration:

Two major reports have been prepared covering the war activities of the Department of Agriculture and the Food Administration. These reports have shown the various factors of the food situation on October 1 and November 1, 1918. The statistical agencies of the Department of Agriculture and the Food Administration have also been studied with a view to disclosing and eliminating duplication of effort. A general analysis of the functions of the Food Administration has been made in the light of reconstruction.

Fuel Administration:

Three major surveys of the fuel situation have been prepared by the Central Bureau and submitted to Mr. Garfield. In addition, fourteen brief surveys have been prepared, showing the fuel situation week by week from August 31st to November 30th, inclusive. Supplementing these surveys, a report has been made on the organization, personnel and functions of the Fuel Administration; and a brief survey of the leading activities of the Fuel Administration since its organization is now in preparation.

Shipping Board and Emergency Fleet Corporation:

Considerable preliminary work has been done toward the preparation of regular monthly surveys covering the Shipping Board and the Emergency Fleet Corporation. Certain of the data assembled by this Bureau has been incorporated in the first consolidated report on the war activities of the government.

War Trade Board:

On the basis of an outline showing the principal objects of the War Trade Board and the means for their accomplishment, reports have been secured from all the bureaus of the War Trade Board setting forth their activities during the period from January 1 to October 1, 1918. These reports, together with various papers and documents relating to the trade agreements entered into by the United States, have been the basis for an extended survey of the activities of the War Trade Board for the first nine months of 1918.

Consolidated Survey of War Activities:

The original plan for a "Conspectus" contemplated a composite picture of all the war activities of the Government, to be submitted monthly for the President's attention. This plan found partial realization in the first Consolidated Survey as of October 1st, which summarized in 24 pages of graphs and tables the progress being made upon the more important parts of the war program, and reflected, among other things: (1) the status of the Army as regards ordnance equipment and ordnance ammunition, chemical warfare service, air service, quartermaster supplies, engineer and motor transport equipment and supplies, and tonnage and "turnarounds"; (2) the status of the Navy with regard to vessel construction, ordnance and aircraft stocks and deliveries, fuel and miscellaneous supplies, and clothing and subsistence; (3) the status of clothing and subsistence for both Army and Navy; (4) the status of the import program by trade regions and by commodities; (5) the control, by trade agreements and the blockade, over exports to the European neutrals; (6) the tonnage available and the status of the shipbuilding program; (7) the fuel situation; and (8) the food situation.

Had the war continued, a consolidated survey of war activities would have been prepared for the President each month. It is believed that such a report would have proved extremely useful in helping the President as the chief administrator of the Government to devote his energies in a way that would have aided most materially in an efficient carrying out of our war program.

Special Studies:

Of the special studies made by the Central Bureau, mention should be made, among others, of reports dealing with:

(1) The Tonnage Available for the Transport of Transatlantic Cargo;
(2) Research Activities Conducted by Governmental and Quasi-Governmental Agencies;
(3) Factory Inspection Activities under the Direction of the War, Navy and Labor Departments and the Public Health Service;

(4) Agencies Engaged in the Gathering of Data Relating to Economic Conditions in Foreign Countries;
(5) Wool Requirements of the Army;
(6) The Distribution and Availability of the Cotton Supply.

II. STATISTICAL CLEARING HOUSE.

The chief function of the Statistical Clearing House is indicated by its title; it maintains and keeps available for instant reference a card file showing just what statistics have been gathered by the statistical agencies of the Government and where they may be had. Toward this end it has built up a practically complete record of commodity, shipping, labor and railroad statistics; and it has compiled and distributed four statistical bulletins, containing a classified list, respectively, of "Food Statistics," "Fuel Statistics," "Mineral Statistics," and "Forest Products Statistics."

To list the first of these, nearly 500 pages, legal size, were required. Two other bulletins, on "Labor Statistics" and "Railroad Statistics," respectively, are in course of preparation.

In order to place the various statistical agencies in Washington in touch with one another's activities so as to develop the maximum amount of effort and wherever possible, to eliminate duplication, the clearing house, since September 11th, has issued the *Weekly Statistical News*. In this periodical, circulation of which is confidential, is listed statistical work planned, under way or just completed. It is a logical means for bringing about a closer coördination of the statistical agencies of the Government, and can, it is believed, be shaped into an instrument of wide usefulness.

In order to give further aid in simplifying and perfecting the machinery for gathering statistical information, the Statistical Clearing House offers expert counsel in the shaping of questionnaires, and within the last few months it has been privileged to serve an increasing number of governmental agencies. As a result, a considerable number of questionnaires which were obviously suffering from one or more questionnaire ailments—*e. g.* undue voluminousness, too many general questions, unconscious impertinence—were brought up to a satisfactory standard. Others which appeared to be unnecessary, unfortunate, or poorly timed, were abandoned.

In this connection, reference should be made to the questionnaire service rendered by the Statistical Clearing House through its service in the chairmanship of a Joint Board on Industrial Surveys, organized to make a survey of conditions holding up production in industrial centers where important war contracts had been placed. The survey represented the joint action of the War and Navy Departments, Emergency Fleet Corporation, Railroad Administration, War Industries Board, Labor Department and Housing Corporation. The work was under way in Philadelphia, Pittsburgh, and a number of other cities when the signing of the armistice made its continuance unnecessary.

PRESENT ACTIVITIES AND FUTURE POSSIBILITIES.

At the present time the Central Bureau is carrying forward four types of work:

(1) It is continuing, in its Statistical Clearing House, to gather information as to statistical data available in various governmental departments, and through the *Weekly Statistical News*, through special bulletins and through telephone and personal service, is endeavoring to make this information available to all those who have use for it. It is also offering expert questionnaire criticism to any of the governmental departments and is endeavoring further to standardize statistical practice.

(2) The weekly and monthly surveys of the activities of various governmental agencies are being carried forward as they were during the active period of the war.

(3) A survey of functions of war-time agencies is being carried forward, special consideration being given to which functions, if any, of those performed by these agencies, should become a part of permanent Government service and to which of the Government departments these functions should be assigned.

(4) In a memorandum dated December 2 and signed by the President, the Central Bureau is designated as the official

source through which shall be obtained economic data required by the American delegates at the Peace Conference. In comment thereon this paragraph is added:

> "It is believed essential that there be one authoritative and exclusive source for the supplying of information of this character. If information is sought through more than one source there is a very considerable probability that conflicting advices will be received which will tend to discredit the whole. Our experience during the war has conclusively demonstrated on the one hand the danger of basing action on the unverified impressions of individuals as to facts, and, on the other hand, the importance of all who are working on a given problem basing their actions on a uniform and official estimate of the facts."

In fulfilling this duty, placed upon it by the President, the Central Bureau has undertaken to bring together all economic information that might be required by the Peace Conference, and has organized a party, headed up in the Central Bureau but composed of representatives of different war boards, that will make this information available at the peace table.

The latter two of these four tasks, on which the Central Bureau is now engaged, will clearly terminate in the course of the next few months. It is my belief, however, that the first two functions should be continued.

Duplication in the collection of statistical information by different governmental agencies increased during the period of the war, but is likely always to exist in a government composed of so many departments and bureaus whose functions are not always clearly defined and frequently overlap. It will always be desirable to have a Statistical Clearing House that will record the nature of all statistical information gathered by the Government and the place where it may be found, that will endeavor to eliminate duplication of work, and that will endeavor throughout the Government to secure the adoption of the best and uniform statistical practices.

Even more valuable, however, than the services to be rendered by such a clearing house are those that may be rendered through the preparation of periodic reports, for the President, on the activities of the various governmental departments.

Compared with our great business concerns, the United States Government has been extremely weak in central administration. The different governmental departments have been almost independent administrative establishments; even the bureaus of many departments have conducted their affairs with little administrative supervision from the heads of the departments and little relation to the activities of other bureaus. One reason for this lack of centralized administration is clearly the fact that our Presidents have, for the most part, never had large administrative experience before entering office. Another equally important reason, however, is the many difficulties that lie in the path of any chief executive who undertakes to inform himself regarding the multifarious activities of the Government. Through personal inspection and inquiry it is practically impossible for him to do so. He must rely upon reports.

The reports our chief executives have been accustomed to receive in the past have not, however, been such as to assist greatly in administrative control. They have not been prepared with sufficient frequency to serve this purpose and have been designed primarily to laud the achievements of the departments, whereas the President, from an administration standpoint, is most interested in things gone wrong that demand his attention. Furthermore, they have never been developed upon a consistent plan or in unified form. The fact is such reports as have been made, at least before the war, were developed more for political effect than as a means for administrative control.

The hope, it seems to me, of preventing a lapse back after the war into the bureaucracy which we had. developed and were still further developing, lies in the continuance as an independent agency in close relation to the President, of an organization such as the Central Bureau, which will prepare for the President periodic reports that will be impartial in presentation of the facts and that will keep him closely in touch with the activities of the various branches of his great organization. To serve this function, if for no other purpose, the Central Bureau of Planning and Statistics should, in my judgment, become a permanent part of the Government.

A ROUND TABLE DISCUSSION OF FEDERAL STATISTICS.*

THE CHAIRMAN (President Mitchell): This session of the American Statistical Convention is to be devoted to a Round Table discussion of Federal Statistics, a topic that is peculiarly interesting at the present time. As the first participant in the discussion I have the pleasure of introducing Mr. W. S. Rossiter.

THE FEDERAL CENSUS.

By W. S. ROSSITER.

The United States has never before approached a federal census under the exceptional conditions that have prevailed during the past year. Up to within sixty days the nation has been steadily concentrating its man power, money and material resources upon the prosecution of a great war 3,000 miles away, and so great was the strain that many, even though in peace times believers in census activities, began to doubt whether the time had not arrived to temporarily curtail the decennial federal census.

When I came to Washington in July and fell in with many workers in statistics from many quarters, this subject came up frequently for discussion. It seemed to be a very open question, whether the government of the United States, calling upon the citizens for all manner of economy, was justified in undertaking a distinctly peace time enterprise upon an elaborate scale, requiring an immense number of employees and a greater expenditure than had ever been made before for a similar undertaking. This diversity of opinion interested me so much that I ventured to make written inquiry of a dozen well-known men, who meet more or less at the Cosmos Club, to answer certain questions as to the scope of the census under the conditions which seemed likely to prevail. I refer to this here, not because it is now pertinent, but because it is an interesting fact that the majority of the replies, which in most instances were carefully prepared and very illuminating, favored the taking of the federal census in very much the same fashion during the stress and strain of war as it would have been taken had the nation been at peace. The preponderating opinion was well expressed by Prof. Thomas C. Adams, as follows:

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*Held at the eightieth Annual Meeting of the American Statistical Association, at Richmond, December 28, 1918.

> "I do not feel that the abnormal conditions of 1920 are a controlling reason for omitting to take a general census on that date. On the contrary it is an added reason why a regular census, taken according to established rules, should be taken. Statistical comparisons have two aims; one to draw the curve of normal progress, the other to measure the variants in that curve due to local disturbances. Unless a census is taken in 1920 this latter benefit is lost to future students. Should demobilization have begun in 1920 and should reconstruction of peace industries have set in, I can see an advantage in an extension of government employment, provided, of course, the object of that employment is a worthy one."

With the sudden collapse of the enemies of the United States and the certainty of our early return to a peace basis, questions as to policy, raised by the fact that the United States was at war, were naturally swept away. It was no longer a question of the wisdom or unwisdom of taking a census, but entirely a question of methods and policies in connection with a census certain to be taken.

The act which authorized the Thirteenth Census, in the preliminary discussions of which, and in the Congressional Committee discussions, I had some part, was made to apply to the "Thirteenth and Subsequent Censuses," because previous experience had shown the costly unwisdom of securing the passage of an individual census act. At the early hearings upon the bill which is now pending, the director of the census submitted a statement which pointed out the differences between the act now before Congress and that which is upon the statute books. The changes in reality are very simple and are merely those required, first, to bring the act up to date; second, to correct inaccuracies or defects which occurred in the practical application of the existing law. The important changes which are introduced, adjust the personnel and properly increase salaries, restate census inquiries, change the date of the census from April 15 to January 1 preceding, and strengthen somewhat the penalty clauses.

The House of Representatives inserted from the floor a requirement for a census of forestry and forest products. The Senate has retained this inquiry so that the usual main inquiries relating to population, agriculture, manufactures and mines and quarries are limited in the current act only with relation to dependent classes, and are expanded by the addition of biennial manufacturers' reports and a census of forestry and forest products.

The pending bill passed the House, was sent to the Senate, subjected by the Senate Census Committee to hearings in September, and was reported to the Senate December 11. It is probable that it will come up for consideration and passage before the close of the present Congress, but of this the director of the census, who is present, can speak with knowledge. Should the legislation now pending fail entirely, however, the mere insertion of a paragraph in an appropriation bill in 1919 will set in motion the machinery which exists under the statute now in existence, and it will be within the power of the director of the census to proceed with the taking of the Fourteenth Census under conditions very nearly as satisfactory as they can be made by the pending act, assuming, of course, that Congress would be willing in the appropriation act to amend the salaries by the modest advances which are represented in the pending bill. Therefore, the director of the census has the comforting assurance that if his first line trench in the form of the pending bill should fail he has the sure defense in the legislation upon the statute book, and he can proceed without any solicitude to form his plans for the coming task.

To no other director of the census has come a greater opportunity, and perhaps I should add a greater responsibility. Some of the problems are so obvious that it is almost a waste of time to enumerate them.

In my opinion, at some time in the near future, there will arise a grave question whether there is not some point at which the magnitude of the population will influence the amount of statistical data which it is practicable to present. While we assume that that limit has not yet been reached, it is a fact that the task becomes decennially greater. In 1920 it will be greater than ever before. In view of this increasing difficulty, what economies can be introduced to avoid excessive increase in cost, since the cost must increase very heavily because the job is larger and all costs are inflated? What changes can be introduced to improve and simplify inquiries and make them abreast of the times in helping to measure industrial unrest?

Civilized society is in a state of bewilderment and apprehension at the present time. Discovery of some of the causes for this condition requires no great search. Other causes are more remote and depend upon many economic and statistical factors. How far can the census of the United States aid in uncovering and clearing up these extraordinary conditions? To the extent that it *can* aid, the director of the census will be performing a duty of unparalleled value to his fellow citizens.

The great problem before the world and in particular before the United States seems to me to be distinctly population. The light which will be obtained from the inquiries upon agriculture and manufacturers, in my opinion, are side lights which will tend merely to throw an illuminating glow upon the great question of *our people themselves*, their composition and the elements which go to their makeup, their urban and rural changes, their occupations, activities and fecundity. If I were expressing an opinion concerning the value of any of the inquiries provided by Congress I should emphatically say that there is no urgent need for the inquiry upon mines and quarries. Much of it is duplicated by the Geological Survey. I should be inclined to reduce this inquiry to very perfunctory terms if Congress continues to insist upon its inclusion, or turn it over to the Survey.

There has never been a time when the director of the census had it within his power to work out more intelligently a comprehensive, rapid and economical census machinery than at the present time. It is, therefore, in the census sense really a noteworthy occasion.

The Census of 1850 was an ambitious undertaking, commonly known as the first reasonably modern census. It was made by a temporary office under an exceedingly capable director, and it differed sharply from the Census of 1840. The Census of 1860 was taken under the shadow of gathering internal disturbance, by a temporary office, and differed decidedly from that of 1850. The Census of 1870 was perhaps the poorest of the modern group. It was made just after the war, much of it taken in areas still in disturbed condition, was impaired by political patronage and was the product of a temporary and rather slovenly office. The Census of 1880, made by a master hand at census taking, was the most ambitious effort ever made up to that date, expensive and elaborate. It was also made by a temporary office, but it was a noteworthy effort, and in that degree differed sharply from its predecessors. The Census of 1890, made by another temporary office, was affected by the spoils system, by changing administrations, and by many marked changes from the Census of 1880. The Census of 1900 was the first determined effort to secure an orderly, effective enumeration, made quickly and under entirely modern conditions. This was also made by a temporary office, the force of which was hastily gotten together, and for this enumeration no advance plans could be made.

Recognizing to some extent these conditions, Congress made the office permanent, under which the Thirteenth Census was the first to be taken. Here, again, another exceptional condition was introduced, for this census differed in turn from all the others by being made under a totally new form of organization.

Now for the first time perfectly comparable conditions appear. The Fourteenth Census of the United States is to be taken by a permanent office, which was permanent when the Thirteenth Census was taken. Here, then, for the first time in the history of the federal census taking is an opportunity for real comparison for thoughtful study far in advance of the various problems connected with each operation. Here is an opportunity to make a detailed analysis of costs to determine whether methods of enumeration applied in 1910 should be continued or superseded by newer and more modern ones; whether, in view of the increasing magnitude of the task other branches of the government service should not be called upon, such as the rural mail carriers, for assistance, and hence whether fundamental changes in methods of enumeration should not be made for the purpose of reducing expenses.

Questions of forms of presentation, and in particular the importance of strict tabular comparability, variation in which always has been a dreadful defect in American census returns, should receive the utmost attention.

Should the huge volumes which have cursed the census in the past, printed upon relatively heavy and cheap contract paper, be longer continued? I venture the comment that while connected with the Census Bureau prior to the Thirteenth Census, the director of the census and I had practically agreed that it was advisable for the census to use, if possible, smaller pages but certainly to use very thin paper, approximating that upon which the "Encyclopedia Britannica" is printed. This plan we had previously introduced in modified form in connection with the Official Register, and were convinced in our own minds of the absolute propriety of such a change.

I have here briefly referred to problems which are arising, because now is the time in which problems should be dwelt upon and arrangements made for giving them the most careful consideration. During my brief stay in Washington I have talked with the director of the census and also have conferred with officers of the two leading statistical associations—the American Statistical Association and the American Economic Association—concerning closer coöperation. Resulting from the conferences which some of us, who are much interested in this subject, have held among ourselves and with the secretary of commerce and the director of the census, the secretary, recently, with the cordial approval of the director of the census, invited the two associations to appoint a joint committee to act as a small advisory group to aid the director in practical fashion in connection with the problems here discussed and many others, such, for example, as the personnel of some of the important new officials required for the Fourteenth Census.

This committee has been appointed, and I have high hopes of its usefulness. The men who have been placed upon it by the presidents of the two associations are, I believe, men of the practical type, who have a genuine desire to be of service, and like many of us who have entered upon war work, have learned during these past few and trying months, that the highest form of duty is service, and not service to ourselves but to our country. Out of the great war have come many lessons, but perhaps this in the end will prove to be the greatest. If it lies, therefore, within the power of these two associations to be of real service to the Census Bureau at this time, the call cannot be disregarded. It is a pleasure to record the cordial attitude of the officials of the department and of the census and their desire to make any practical move which seems to promise real results. It is to be hoped that the committee here mentioned will be able to hold meetings at stated intervals; to take up for consideration definite problems to be assigned to it by the director of the census, and to make thereon specific, practical and helpful reports, so that he may feel that he has the assistance of a trained group of men who will help him solve the problems confronting him on all sides in his great task.

THE CHAIRMAN: Next, I have the pleasure of introducing the director of the census, Honorable Samuel L. Rogers.

RECENT PROGRESS AND PLANS OF THE BUREAU OF THE CENSUS.

By SAMUEL L. ROGERS.

I am glad of this opportunity of meeting the members of the American Statistical Association, and I can assure them that I am in full sympathy with their aspirations for the development and improvement of statistical work in the United States. Representing as I do the principal and, in fact, the one distinctively statistical bureau of the national government, I am, of course, actively interested and concerned in any discussion of the subject of federal statistics. Of the total output of such statistics I should judge that something like 80 or 90 per cent. is compiled and published by this bureau. It is a bureau whose sole function is statistical. It has no executive duties or participation in the control of public affairs or the regulation of private interests. Its objects, in fact, are precisely those of the American Statistical Association as defined in your constitution, namely, "to collect, preserve, and diffuse statistical information in the different departments of human knowledge." In other words it is a purely scientific bureau which might properly adopt as its motto: Statistics and nothing but statistics.

It has been a matter of regret to me that I have not seen more of the members of the American Statistical Association and become better acquainted with them. It was because I felt the need of your coöperation, counsel, and support that I requested the appointment of the joint advisory census committee representing this organization and the American Economic Association, and I anticipate that that committee will be of great assistance in formulating and carrying out the plans for the next census.

I believe that no one appreciates more keenly than I do the value and importance of reliable statistics, although I do not claim to be classed as a statistician. It has certainly been my purpose and desire that the statistics emanating from this bureau shall be such as will come up to the standards and requirements of statisticians and merit the endorsement of your organization. It will be four years next March since I received my commission as director of the census, and I believe, gentlemen, that my brief record as the official head of that bureau is good evidence of my purpose. I believe you will bear me out in the statement that during my term of office the high standard of excellence in the statistical work of the Census Bureau has been fully maintained. More than that, I think I can claim that the census publications issued in this interval represent a considerable advance and improvement over anything the bureau has before published on the subjects to which they relate. I will mention in this connection the report on the Negro Population of the United States which was prepared by Dr. John Cummings. It is unnecessary for me to point out to the members of this Association the rare qualifications he possesses for a work of this character. For many years to come this single volume of about 840 quarto pages will constitute the most complete, comprehensive, and valuable storehouse of statistical data relative to the Negroes that has ever been published. Another census publication which I can mention as an evidence of a high standard of statistical excellence in our work is the report on Prisoners and Juvenile Delinquents which was prepared by the President-elect of this Association, Dr. Hill. I may mention, also, the reports on the Blind and Deaf Mutes prepared under Dr. Hill's supervision by Reginald L. Brown, another member of this Association.

About a year ago we issued a statistical monograph on cancer, presenting in great detail the mortality data for this obscure and dreadful malady and distinguishing carefully those cases in which the diagnosis was based on an autopsy or surgical operation and therefore not open to question from those more or less doubtful cases in which it was based on clinical findings. In the preparation of this report the bureau had the benefit of the advice and coöperation of the American Society for the Control of Cancer, as represented by its Statistical Advisory Board, on which are the names of Hoffman, Wilbur, Guilfoy, Dublin, Lakeman, Willcox, and Mayo. The results of this statistical investigation are, I think, generally recognized as a valuable contribution to medical science. A monograph of similar character on tuberculosis is in preparation.

I may mention also the Census Life Tables, which were prepared under the direction and supervision of James W. Glover, professor of mathematics and insurance in the University of Michigan, and which form the first comprehensive life tables applying to conditions in this country.

The work of the Division of Vital Statistics, under the direction of the chief statistician, Dr. William H. Davis, is being steadily extended to cover a larger area of the United States for the registration of deaths and to include also a registration area for births, the latter comprising all of the New England states, together with New York, Pennsylvania, Michigan, Minnesota, Maryland, and the District of Columbia. Two annual reports on birth statistics have been issued. The registration area for deaths now comprises 78 per cent., that for births 53 per cent., of the total population of the

United States. The bureau is now publishing a weekly health index showing deaths and death rates in the principal cities of the country in the previous week with comparative figures for earlier years.

The bureau for many years has annually published Financial Statistics of Cities, and since my connection with the bureau this branch of our work has been extended, under the initiative of Starke M. Grogan, chief statistician, to include the financial statistics of the states as well, so that we are now issuing annual reports on this subject also. Most favorable comment has been received in reference to the recent publications prepared by this division of the bureau. In particula- the report on "Specified Sources of Municipal Revenue: 1917" being a new subject has created a very wide interest. At this time when municipalities are struggling with the problems of raising funds for needed improvements and planning for the reconstruction period after the war, carrying the heavy burdens that naturally go with taxation, the information contained in this report is of especial value.

The Division of Manufactures under Mr. W. M. Steuart, chief statistician, brought to completion the immense work of the quinquennial census of manufactures and made the results available in a shorter time than ever before.

On account of the importance of shipbuilding arising from war conditions, a special census of the shipbuilding industry was authorized by the secretary of commerce, and taken for the calendar year 1916. These data, with comparative figures for 1914, were furnished promptly to the United States Shipping Board and to the Emergency Fleet Corporation, and were of much value in the initial work of these newly-created agencies of the federal government.

Under the present chief statistician for manufactures, Mr. Eugene F. Hartley, who succeeded Mr. Steuart in June, 1917, the division in addition to the regular investigations has conducted, at the request of the war boards and upon the special authority of the President of the United States and the secretary of commerce, a number of investigations which have been grouped under the title "Census of War Commodities." A mere enumeration of these investigations reveals the wide scope and importance of this war work, and is as follows: Census of edible oils; census of acids and chemicals used in the manufacture of explosives; statistics of jute, kapok antimony, silk, and graphite crucibles; monthly statistics of leather stocks on hand, and boots, shoes and manufactured leather goods; statistics of iron and steel covering stocks on hand, consumption and requirements; and a census of wool manufactures covering machinery and production—the data for production for the years 1915, 1916, and 1917. The collection of these statistics and the prompt furnishing of the results to the war agencies has called forth the highest commendation not only from the war boards for which primarily the data were gathered, but has also elicited noteworthy praise from associations of industry who have benefited by the dissemination of the statistics.

In August, 1918, under the initiative of Mr. William L. Austin, chief statistician for agriculture in the Bureau of the Census, a conference was held in Washington for the purpose of preparing a general schedule of agriculture for the coming census.[*] About 40,000 copies of the schedule agreed upon by this conference were printed and this edition was distributed and tried out by the township and county agents of the Department of Agriculture. Later in the year similar conferences were held on irrigation and drainage, and tentative schedules have been prepared covering these subjects also.

The Division of Agriculture in the meantime is preparing in advance, so far as practicable, the copy for the statistical tables for the Fourteenth Census reports, inserting the figures of previous censuses but leaving, of course, the columns for 1920 blank, to be filled in as soon as the figures are available.

In May, 1917, immediately following the passage of the selective-service law, the Bureau of the Census published an

[*] The participants in this conference included Dr. Le Grand Powers, formerly chief statistician for agriculture, and Dr. John Lee Coulter, formerly expert special agent in charge of agriculture; Mr. William A. Hathaway, Mr. W. J. Barrows, and Mr. Clarence Hurry, all of whom were connected with the division of agriculture during the Census of 1910; and Dr. George F. Warren of Cornell University, Dr. Henry C. Taylor of the University of Wisconsin, and Dr. Clarence Poe, editor of the Progressive Farmer. The representatives of the Department of Agriculture, appointed by the secretary, were Mr. L. M. Estabrook, statistician and chief of the Bureau of Crop Estimates; Mr. Charles J. Brand, chief of the Office of Markets; Mr. W. J. Spillman, chief of the Office of Farm Management; Mr. L. C. Corbett, chief of the Office of Farm Horticultural Investigations; and Mr. George M. Rommel, chief of the Division of Animal Industry.

estimate of 10,077,700 as the total number of men 21 to 30 years of age, both inclusive, in the United States. The actual registration on June 5, 1917, was 9,691,344; but if to this number were added approximately 400,000, representing men within the specified ages who were already in the military and naval services and therefore not required to register, the total would be brought very close, indeed, to the estimate.

On July 30, 1918, at the request of the provost marshal general, the bureau estimated the number of men aged 18 to 20 years, inclusive, and 32 to 45 years, inclusive, in the United States on July 1, 1918. The total given by this estimate was 13,194,408. The registration on September 12 was 12,870,000, to which number should be added approximately 400,000, representing men within the ages specified who were already in the service. The total thus obtained, 13,270,000, differed from the estimate by only a little more than one-half of 1 per cent., thus again confirming the substantial accuracy of the bureau's figures.

The work of classifying the occupations of registrants was undertaken at the request of the provost marshal general, dated December 21, 1917, that a detachment of skilled workers from the Census Bureau be sent to the War Department to train the clerks who were to be assigned to the preparation of an industrial index of the registrants under the selective-service act. The preparation of this index consisted in the classification, according to occupational skill or experience shown, of cards prepared by the local registration boards from questionnaires filled by registrants. The census scheme of classification of occupations was used.

The total number of cards received to the end of June, 1918, and classified under the direction of the expert census force was 8,147,034. In the classification and verification of these cards it was necessary to handle most of them two or three times, so that the total number of handlings of cards, for all purposes, amounted to 23,707,872.

The work, which was carried on under the supervision of William C. Hunt, chief statistician for population, was, in some respects, very complex and could not have been successfully handled by inexperienced employees. The skill and energy displayed by the Census force were greatly appreciated by the provost marshal general, who, in a letter dated June 26, 1918, to the director of the census, paid a high tribute to the value of the service rendered in the prosecution of this important piece of war work.

The bill for the next census which has passed the House and been reported in the Senate contains a provision for a biennial census of the products of manufacturing industries. This, I may explain, does not mean that a complete and comprehensive census of manufactures, such as is now taken quinquennially, is hereafter to be taken every two years. That would probably be impracticable as well as unnecessary. What we have in mind is a census of production giving the value and, so far as practicable, the quantity of products turned out in the given year by our manufacturing industries. This does not supersede the main census of manufactures which, under the law, will be taken every five years as heretofore.

The bill restores the provision for a quinquennial census of agriculture, which was contained in the Act for taking the Thirteenth (1910) Census but which Congress repealed when called upon to provide in 1915 the appropriation requisite for carrying out this provision of the law.

There is a great need also for a quinquennial census of population. This has been especially impressed upon me since I became connected with the bureau, through the difficulties and embarrassments I have experienced in obtaining satisfactory and reliable estimates of population for the computation of death rates and per capita rates. Ten years is too long an interval to be allowed to pass without an enumeration of the population, especially in a country like the United States where population growth is so unequal and variable in different communities and different periods, being affected and largely determined by the fluctuating tide of foreign immigration and also by the migration in large numbers from country to city or from one section of the United States to another. Under conditions such as these estimates based on the assumption of a uniform annual increment of growth in the population of each individual city become very uncertain and unreliable in the latter half of the decade although for the first four or five years after a census is taken they will probably not deviate widely from the facts. I am sure that I can enlist the coöperation and support of this Association in any movement for the inauguration of a quinquennial census of population to be restricted to an enumeration recording a few fundamental facts such as sex, color or race, age, and nativity. But this is a matter for the future.

For the next two or three years it will be necessary for the bureau to concentrate all its resources and energies upon the task of taking the Fourteenth Decennial Census of the United States, covering the subjects of population, agriculture, manufactures, mines, quarries, and forest products. I think I fully realize the magnitude of this task and its peculiar difficulties, which are greater at this time perhaps than ever before owing to the high cost of labor and the more or less disorganized conditions consequent upon the war. In this great undertaking I feel the need of obtaining the benefit of the coöperation and counsel, the scientific knowledge and broad outlook, of the liberally educated economists and statisticians of the country, and more especially those of them who have been closely associated with former censuses. Through the agency of the joint committee to which reference has been made, I hope to establish a closer contact with the men of this class.

I realize also the need of having a larger number of trained statisticians and experts on the staff of the Bureau of the Census. I have a few such men, and I believe that none better could be obtained anywhere. I need more of them, but it is difficult and almost impossible to get them with the salaries I can offer under the existing law. The bill for taking the next census, however, as now reported to the Senate will improve the salary situation very materially and enable me, I trust, to secure the grade and number of assistants required for that task. It does not give me all I would like to have in the way of higher salaries but it gives about all I thought it wise to ask for, and there is no feature of the bill regarding which I have been more solicitous or more insistent than I have about this. I have urged the importance of higher salaries upon the Senate Committee individually and collectively with all the eloquence I could command. I am not sure that I can command much or even any at all, but be that as it may, I talked to them very earnestly on the subject, and I can assure you that it is a great relief to me that in the bill as reported to the Senate the salary increase features, stricken out in the House, have been in the main restored. I trust that we shall now be able to put the bill over without sacrificing these increases.

Under this bill as it stands the salaries of the chief clerk and of the three chief statisticians who will have charge of the main divisions of the Fourteenth Census work will be $4,000. This, in the case of the statisticians, is an increase of $1,000, and in the case of the chief clerk of $1,500, over the salaries which they are receiving now, and which they received during the Thirteenth Census. The geographer will receive a salary of $3,000, which represents an increase of $1,000.

The other two chief statisticians and the additional one provided for by the bill will receive $3,000 each, which represents no increase. I had asked for an increase to $3,600, but the argument was made that the work and responsibilities of these officials would not be increased in consequence of the census, as they have charge of annual inquiries which will be carried on as usual. The argument is valid as far as it goes, but the fact remains that the present salaries of these positions are inadequate.

The Census Bill, if passed in its present form, will permit me to appoint as many as twenty-five expert special agents at a salary of $10 per diem. In connection with the Thirteenth Census, Director Durand, by means of supplementary legislation, passed after the enactment of the main act, obtained authorization to employ twenty expert special agents at a salary of $8 a day. The present bill will, therefore, enable me to obtain a larger number of these experts—twenty-five instead of twenty—and pay them a higher salary—$10 a day instead of $8.

The bill further authorizes the appointment of fifteen statistical experts at a salary of $2,000. One object of this was to provide for some of our high grade clerks, many of them women, who, through long experience and training, have acquired a skill in statistical work and a knowledge of statistical methods which is most invaluable to the bureau and who deserve greater recognition and reward than the position and salary of a clerk affords.

I should be glad to establish in the bureau a division of statistical research, enlisting for that purpose the services of the very best statisticians that I can obtain. I have recommended in my last annual report that the bureau be made a permanent clearing house for all statistical information issued by the executive branch of the federal government. This could be done by having all the executive departments and independent government establishments submit reports, monthly or quarterly, to the Bureau of the Census describing all statistical data compiled or published during such period, thus enabling the bureau to detect any duplication or overlapping existing in the statistical work of the government and recommend its elimination. It would also make federal statistics more easily available to the public and to persons engaged in research work and would result in bringing about a material saving in expense.

In general it is my ambition and hope that when my term of service as director of the census terminates I can have the satisfaction of knowing that I have been instrumental in effecting an improvement in the organization and efficiency of the bureau, accompanied by a general advance in salaries for the supervisory officials and experts and an increase in the number of qualified statisticians in the service.

I have called your attention to some features of the work of the bureau and of the bill for taking the next census, not to boast of our achievements, which I realize come short of the ideal, but partly because I know you are interested in learning what we have done and are undertaking, and partly because I want to assure you by these evidences that I am endeavoring to increase the efficiency of the bureau and improve and develop its work in the direction of greater usefulness and a higher standard of excellence. In this endeavor I shall solicit and welcome the coöperation and support of the American Statistical Association.

THE CHAIRMAN: We will next have the pleasure of listening to Prof. Davis R. Dewey:

Professor Davis R. Dewey: I have not come into very close contact in the past few years with this particular field and consequently do not feel as well informed as I ought to be in regard to the progress of the federal work. I shall simply present one point which comes from my own experience as possibly contributing some suggestion of one of the possibilities which perhaps would be of help. I teach the subject of Statistics. I have a class in that in each year in the institution with which I am connected. I use for my first textbook the Statistical Abstract of the United States by which to introduce these students to the range of statistics and accustom them in some degree to the practice. I wish to express my appreciation of that volume. Those of us who have had occasion to use that series know that it goes back for some thirty years and has been of great help to us as a book of reference.

Now, there is a great deal of activity with regard to statistical work in all the various departments and bureaus in Washington and my need is to have brought together in some volume the substance, in summary tables, of all of this work. The Statistical Abstract when it was originally planned did, I presume, cover the ground with fair completeness. These tables, properly enough, have been continued to the present time in order to secure comparability. At the present time this volume does not by any means cover the range of the statistical activity of the different bureaus; it is incomplete; you cannot find in it a great deal of the material that one would wish. I speak from memory, but you cannot find in the Statistical Abstract as I recall it, any data in regard to the mortality in the larger cities in the United States. There is a table relating to the mortality of some of the smaller towns. Nor are there assembled in that volume statistics of prices over any period of time, or statistics of wages. These are illustrations of some of the omissions. There are still included in the volume tables which are, I imagine, of very little use except to the rare specialist in some peculiar subject, and which might now be omitted in the Abstract. I think a great service could be rendered if some centralised statistical bureau in Washington, whether it be the Census Office or the Bureau of Commerce which I believe publishes the present Statistical Abstract, or some other office, should, after some careful plan which has been prepared, extract from the different bureaus the material which has a wide and permanent value. I speak from selfish motives, so as to save us the time of searching for this material. Those of you who are more intimately at work know just where to ascertain it, but the person who is not keeping up his points of contact, has not so many supports to lean upon. To show the stress which the ordinary man can be put to, the first thing I always refer to when I want to look up a question of statistics is the World Almanac, which has the greatest variety of information of any book that I know of, and subsequently I turn to the Statistical Abstract or one of the Census Volumes. My one suggestion, therefore, is that we ought to have by some branch of the federal government a compilation which is a little more modern and more complete, of the statistical work undertaken by the other bureaus. There is a very useful volume published by the English Government, "The Statistics of Labor"—I do not recall its exact name, but it is an annual which brings together all of the principal material collected by different offices dealing with labor matters, as wages, employment, etc. We have no volume in our service which compares with that. The trade statistics which are collected in part in the Statistical Abstract ought to be improved and made more serviceable. I believe that if some such volume as this could be prepared it would receive the very sincere appreciation of all those who have to do with government statistics.

THE CHAIRMAN: I regret that neither Dr. Stone, Dean Gay, nor Professor Willcox is able to be present this afternoon. I shall therefore call next upon Mr. William A. Hathaway.

MR. W. A. HATHAWAY: When Dr. Mitchell asked me if I would come and join in this round table discussion, I asked him, even so late as last night, what was the general tenor of the meeting and what he wanted me to say, and all the help I could get was that he wanted me to be the last one and kind of sum up. Well, as it turns out, my job is a very easy one, not that there has not been a goodly supply of valuable suggestions made here, but that each speaker has himself made a very fine summary of what he has said.

However, it seems to me that it is especially fitting that this Association should devote an afternoon to the discussion of Federal Statistics, and more particularly the work of our Federal Census Bureau, because the most important statistical piece of work before the country today—I care not whether we look at it from the standpoint of the business man, the scientist, student, or academician—is the Fourteenth Decennial Census of the United States. After all is said and done, we must look pretty much to the product of the Census Bureau for official facts and statistics. This is not casting any aspersions on other statistical work of the government, but is true because the work of the census has become so comprehensive that it embodies, as the director has just said, a very large proportion of our governmental statistical product. And certainly all who are engaged in statistical work, and the members of this Association in particular, must have closely at heart the work of the Census Bureau and especially this next big census. The director's presentation of the work and something as to his aims and hopes for the next census must cheer our hearts, and particularly the announcement that he has provided for a joint consultation committee of experts to be designated by this Association and the American Economic Association. In view of this, it would be inappropriate for me to go into detailed discussions or suggestions of schedules or methods. Those of us who have anything to contribute on that score will have an opportunity to do so through this joint committee. However, as a basis for further discussion from the floor, it may not be amiss to call attention to a few outstanding features:

First, I rather take exception to the remark of the first speaker (Mr. Rossiter), that he considered agriculture and manufactures more or less side lines to population statistics, which he denoted as the basic statistics. It seems to me that the statistics of manufactures and agriculture are going to be more important than ever before. We are to see probably—and I hope it may be possible to stress this idea in the scope of the inquiries and schedules—what effect our tremendously stimulated industrial life is going to leave on our manufacturing industries. The same is true of agriculture. We are going to see more clearly what effect war prices have had upon stimulating production. After all, the really big problem of our return to peace is the labor problem. And this boils down, in its last analysis, to the proper distribution of the products of industry. What shall be the share of the worker and what shall be the share of the entrepreneur? For a sound economic solution of the question we need to know pretty definitely how much product there is to distribute between the two contending classes. So the production statistics of agriculture and manufactures are tremendously important at this time.

We all realize and deplore the dearth of enlightening statistics dealing with the wage question. I hope and suggest that the census officials and the joint committee will give particular attention to wage statistics. While the statistics collected by the Bureau of Labor Statistics are helpful, they are far from giving us a satisfactory answer to many of our problems. The census has an opportunity at each census period to gather, at small cost, statistics on wages for over one-third of our gainfully employed workers, since they are engaged in the establishments which the bureau will canvas. This is an opportunity that ought not to be overlooked.

There is another suggestion that I wish to make concerning manufactures, namely, that the census emphasize the idea of physical units as a measure of production rather than value. This can be done by requiring the kind and *quantity* of products from more industries than at present.

Mr. Rossiter's suggestion that mines and quarries be omitted, should, I think, be considered very carefully. It is true we have, in the Geological Survey and Bureau of Mines, fairly complete statistics of production of nearly all kinds of mining products, and if the occupation statistics of the census can be so improved as to show better the number of people engaged in the mining occupations, perhaps the complete enumeration of mines and quarries might be omitted at this time. Each recurring census grows more difficult on account of the tremendously increased cost of enumeration and tabulation, which is likely to be greatly aggravated at the next census by high prices. And if some of the general inquiries must be omitted, probably mines and quarries can be spared best.

For the occupational statistics I plead for very careful consideration. Certainly the country needs now as never before to know where our workers are employed and how distributed by industries and specific occupations. I do not know of any one volume that the census produces that is used more by all classes of people than the one on occupation. There is a very fertile field for improvement in classifications, and a real need to have the occupational work carried right along with the regular population tabulations rather than let it go over to a subsequent period, which delays the publication of the occupational results.

The director has mentioned more frequent enumerations. We are indeed thankful to him for his efforts to get through a biennial census of manufactures which would fill a wide gap in our statistics. Coupled with the quinquiennial census, it will give us pretty accurate information about the changes in our industrial life. I hope five year censuses of agriculture may also become a reality in the future. These have been provided for by legislation, but Congress did not appropriate the money to carry it out in 1915. The enumeration could be done by rural mail carriers, correspondence, in coöperation with the agents of the Department of Agriculture, which would not make the cost prohibitive.

Although we need a quinquiennial census of population very badly, I fear the cost would make it impossible to get favorable legislative action at this time. The census has done splendid work on estimating the increase of population between census periods, but I think possibly that work could be pushed a little further and thus make up for more of the deficiencies due to the lack of more frequent enumerations.

It is not my place to speak of office administrative matters, but there is just one thing I would like to mention, and that is the arrangement of the office work on the publications. I hope it will be possible for this census to have a more simplified program than the last. There was then such a deluge of general and special bulletins and reports, both preliminary and final, for states and the country as a whole, that even many of us in the bureau were hard put to keep up with them, and if we were in that position, how must the layman have fared? It seems to me that it would be entirely feasible to publish a series of state bulletins, each dealing with population, agriculture and manufactures; follow these up with the abstract for the entire country; get these out very promptly; and let the detailed analyses come along as time and money permit.

The last speaker (Dr. Dewey) voiced a suggestion in which I heartily concur; namely, the need of a better Statistical Abstract of the United States, compiled by the Bureau of Foreign and Domestic Commerce. I would add to his suggestion, the necessity for some governmental agency to bring into one volume more world statistics on population, agriculture, manufactures, wealth and debt, foreign trade, etc. We are never again going to be an isolated nation, and the need and demand for world statistics is going to be very much greater than it has ever been before, and it seems to me that the compilation of such a statistical abstract yearly that will bring together the statistics of our own country and those of foreign countries would be invaluable to everyone in the United States. Now, who should do that work is another question. I never could see why in late years the Bureau of Foreign and Domestic Commerce got out the Statistical Abstract. I presume it is simply one of the accidents that happen in governmental work. It started there. I imagine when the main tables in the volume related to our foreign trade, but foreign trade is not now more important that many other subjects included. It would seem to be the function of some centralized agency or bureau more than that of its present compilers. This emphasizes the need for a centralized statistical agency that could supervise and coördinate such work, as the director of the census has mentioned, and I hope that this Association may get behind the project and help carry it to fulfillment. I think we all agree that the cat needs a bell and I hope we are not going to fall out as to who is going to do the belling. I think if we get together in a spirit of wise coöperation and council there will be no hitch on that score. I thank you, gentlemen.

THE CHAIRMAN: We shall now be glad to hear from anyone present who would like to discuss any angle of the rather broad field of federal statistics, a subject in which we hope the American Statistical Association may, in accordance with the program that has been arranged by the director of the census, take a more active part than it has heretofore.

DR. DAVIS R. DEWEY: May I ask whether there has come under discussion before the Association any proposal whereby some of the newer or more recent work which has been done by some of the statistical officers in Washington will be taken over by other branches of the government?

THE CHAIRMAN: So far as I know the matter has not been formally laid before the Association.

DR. DAVIS R. DEWEY: If you were not in the chair I could speak more freely. We all of us know, I think, of the work which has been done, for example, in connection with prices under the more immediate direction of the Chairman, and there is other work of that sort which I hope may be permanently retained. It would be very unfortunate indeed if this is going to be lost. Certain methods have been devised which we ought to take advantage of in some statistical bureau, and while I am not prepared to make any definite proposal, I hope that some one who is better acquainted with the machinery and the possibilities that exist in Washington will make some suggestion whereby this work can be taken over by some permanent bureau and the more valuable part of it continued.

THE CHAIRMAN: Mr. Hartley, is it asking too much to suggest that we would be glad to hear from you on that subject particularly?

MR. HARTLEY: I think that subject has been covered very briefly by Director Rogers in his remarks. The work undertaken by the Census Bureau has been such collection of statistics of war commodities as seemed rather difficult to be attempted by the temporary agencies of the government. I think, however, answering the question of Dr. Dewey, that a movement is on foot by certain industrial associations to try to preserve some of the essential statistics which have been compiled at more or less frequent intervals on account of war conditions. For instance, I think the recommendation was made by the War Service Committees, in connection with the meeting at Atlantic City of the United States Chamber of Commerce, a very short while ago, that the statistics for the leather industry be continued, say at quarterly intervals instead of the monthly collection of such statistics as has heretofore obtained. I do not know but that this recommendation is a good one. It certainly seems feasible. I believe that certain other statistics collected on account of war conditions could very well be perpetuated by some government agency—not necessarily by the Census Bureau—but certainly the important statistics that were compiled on account of war conditions could be carried on at more or less frequent intervals. I want to say on behalf of the Census Bureau that we welcome this opportunity of meeting with people from the outside. It is always helpful to get the viewpoint of what is wanted by those who are using statistics and they also get our viewpoint and understand the conditions under which we work. It has been a very great pleasure to have listened to the discussions; they have been more helpful that I even anticipated.

DR. HILL: Mr. President, I feel sure that all members of the American Statistical Association heartily endorsed the suggestion in your excellent presidential address that the Association broaden its usefulness in connection with the subject of federal statistics; and as a step in this direction we welcome the announcement of the appointment of a committee to coöperate with the Census Bureau in carrying on its work. It seems to me, however, that the Association may go even further than has been suggested and become even more influential in guiding or determining the future development of the statistical work of the United States Government. Perhaps it will not appeal to you as the proper thing for a statistical society to do; but I would like, at any rate, to raise the question of whether this Association, when some proposition looking to the development, enlargement, or improvement of federal statistics meets with its approval, might not as an organization properly engage in an active or even aggressive campaign to secure the adoption of that particular proposition, whatever it might be. Take, for illustration, the suggestion for a quinquennial census of population. Suppose that after thoroughly discussing this matter, hearing everything that is to be said upon it pro and con, considering its cost in relation to its value, we become convinced that a population census should be taken as often as every five years. In that case, would it not be entirely proper for this society to undertake to secure the enactment of a law providing for a quinquennial census? You might ask, perhaps, what we could do to accomplish that. I think we could do a great deal if we set about it in earnest. In the first place we could formally express our approval of the proposition, and go on record as approving it; that would be something. Then we might carry on more or less propaganda in favor of the proposition, writing it up in our journal and other publications, and generally educating public opinion on the question. Perhaps we could not reach a very large public in this way, but I think the public that we did reach would include a group of very influential men. We might take steps to enlist the support and coöperation of other organizations. We probably could easily secure the support of the American Economic Association, also that of the American Sociological Society and similar organizations. We might, furthermore, enlist the coöperation of the trade organizations and chambers of commerce; and in that connection it may interest you to know that the National Chamber of Commerce, acting, so far as I am aware, upon its own initiative, formulated and introduced into Congress a few years ago a bill for a Central Statistical Commission, thus indicating an active interest in statistics on the part of that organization. Furthermore, we could make it our business to see that a bill providing for this or whatever the particular measure may be in which we are interested is properly drawn and introduced in Congress. It is not a very difficult matter to get a bill introduced; it is not always so easy to get it passed, but there is always some gain in having any measure definitely formulated in a bill. And it is possible that after such a bill was introduced that we might, individually or as an association, endeavor to interest members of Congress in the measure. As an association we could memorialize Congress and as individuals we could write to our Congressman. Any bill relating to statistics is ordinarily referred to the House Committee on the Census or the Senate Committee, as the case may be. Those are practically the statistical committees of Congress and we might use our powers of persuasion with the members of these committees to interest them in our pet proposition. At every Congress a new committee is organized. Would it not perhaps be possible for the American Statistical Association to canvass the members of the House and Senate, and if we found certain men there whose associations and antecedents indicate that they will appreciate the value and importance of statistics endeavor to secure their appointment on those committees?

These are merely suggestions of things that we might do, and it may perhaps seem to you that as a scientific society it would not be advisable for us to engage in any such undertakings, but I think the idéa is worth considering,—worth thinking about. I believe we might safely proceed to organize our work on the assumption that within the limits of what is reasonable and practicable the American Statistical Association can get what it wants in the way of federal statistics, if it knows what it wants, and wants it bad enough to go after it. Looking to the future we might draw up a somewhat broad statistical program for the federal government. It might be a program that we could not hope to realize in less than fifty years—but no matter. I trust that this Association is going to last fifty years and more, so that we can look ahead to a long life of usefulness. We could take first the most urgent features of such a program and concentrate on them, trying to put them through first of all, and then take up the others. As I have said, this is a suggestion of possibilities which I would like to submit for your consideration.

MR. CHANEY: It occurs to me that it might be entirely possible for this Association to request the committee to be formed with reference to the coming census in conjunction with the Committee of the American Economic Association, to consider and perhaps to draft a program of general procedure; that some such general program carefully worked out and extending into every statistical organization outside the census is very desirable, no one who has been associated with any of the bureaus can fail to realize. I think I happen to be associated with the only bureau which has the term "statistics" in its name—the Bureau of Labor Statistics.

I have listened with some interest to the remarks made in order to learn whether it is understood just what the Bureau of Labor Statistics is supposed to do, what idea this Association has with regard to the functions of that particular body. I was led to reflect upon it by the suggestion of one of the speakers that we needed a more careful collection of facts with regard to wages and prices. It happens that the Bureau of Labor Statistics is specifically directed in its organic act to collect exactly that sort of information; that is what it is for more than anything else. In a general way it is supposed to collect information with regard to the interests of the laboring classes but specifically for their benefit they are to be told how much they earn and how much they spend and various other things of that sort, so it seems to me that if the Association desires more specific information than it now obtains with regard to those subjects, it becomes germain for it to insert a prod in the person of the Commissioner of Labor Statistics—it is his duty to turn out these things for your benefit. No one would more readily admit that I think than the commissioner himself. He not being here to speak for himself, I take the liberty of saying that he should be incited to further effort along this line if this Association desires more than he now gives.

The remarks of Dr. Dewey seem to me to be applicable in a case of this sort. The Statistical Abstract, so far as I know, does not publish any of the details which the Bureau of Labor Statistics produces. I have never seen any of them there and, in order to find the tables of my own Bureau in the most accessible form, I am obliged to refer to the World Almanac. It is a good deal easier to go to the World Almanac where they have been collected together than it is to go through our own publication and find them. So I keep a volume of the World Almanac on my desk in order to be informed in regard to what my own bureau is doing. There is certainly an opportunity for valuable service somewhere in bringing together as the World Almanac does now imperfectly, the tables which are produced by the different bureaus of the government.

Dr. Devine: It may not be relevant to this discussion, yet I hardly see how we could discuss such a broad theme as this without someone raising the question as to whether this is not the time for complete and constant records of registration of the whole population. It seems to me that, at a time when all of our male population between 19 and 45 has been made subject to a draft, when we have had such an elaborate questionnaire filled out as we have had, when 25 per cent. of our people have enrolled in patriotic service like the Red Cross, when the whole public has been used to the idea of giving information about themselves, when the larger portion of the population have had to make a statement in regard to their income, there must be a state of public opinion that would be responsive to this subject and that this would greatly lessen the psychological difficulties, if not the financial ones, that would accompany such a registration.

My interest, of course, in this whole discussion is not that of a teacher of statistics but that of one interested in social reform, public health work, relief work, and other social work of various kinds that would be enormously facilitated by such information as could be obtained by such a registration. If there is any possibility of our having any form of universal military service hereafter, there would certainly be an adequate legal and constitutional basis, if any question should be raised on that subject, for the keeping of such registration under some kind of federal supervision. If we are going to be interested in young men of eighteen years of age we must begin that interest, if it is to be at all satisfactory, at the time they are born. This consideration has been found sufficient in European countries.

The practical advantages in planning educational work and public health work, in knowing such things as the movement of population from one city to the other, from the country to the city, and so on; and the practical benefits in dealing with crime of all sorts that would come from our knowing at all times where all the people are, are so obvious and so enormous that it seems almost unnecessary to insist upon them. One of my students once made up a list of about thirty registrations in New York City that would be unnecessary if we had one complete registration of the population, accessible to all the different federal and state activities that would have use for it. All of us realize, of course, that this registration would not take the place of a periodical census count, but it seems to me clear it would spread a most useful background for the census that we may still have to take.

Mr. Swazey: As representing an organization that has occasion to use statistics of foreign countries as well as those of this country, I wish to second very heartily Mr. Hathaway's suggestion that the Statistical Abstract combine more of the information of foreign countries than it does at the present time. Some of that information, a small amount of it, is available in our old friend the World Almanac, but other than that we are forced to rely upon such publications as the British Statistical Abstract of Foreign Countries, which is complete, but of course now during war conditions considerably behindhand, and always somewhat behindhand and not available to a number of people who would like to use it, because it cannot be gotten readily in this country—the Statesman's Year Book. I certainly think that any information of a kind this contains, which could be compiled each year and embodied in the Statistical Abstract would be of very great advantage to the large and increasing number of users of foreign statistics.

Major Huntington: I believe the definition of a round table is a place where everyone may ride a hobby. I have one hobby: printing, typographical presentation of mathematical tables. As an entirely unprejudiced outsider, not yet by a couple of hours a member of this Association, I should like to say that we do not find it very easy to refer to most government publications of tabular material. The type fails to distinguish 8 and 3, 9 and 6, etc. With a little thought on that subject and a little conference with those who have given the matter attention, I am sure great improvement with no increase of space could be effected. I have made some rather startling comparisons between different kinds of type which I should be glad to put before any member of the Association who has to do with the actual printing of tabular material.

Mr. Hartley: A statement was made as to the collection of statistics of mines and quarries. I do not think it was sufficiently brought out that there is no duplication in cost or effort in the decennial collection of statistics of mines and quarries by the Census Bureau. For instance, the regular decennial census of mines and quarries covers statistics of capital, wages, persons employed, materials used, and the total output of the various mines and quarries. In the decennial census year the work is carried on in coöperation with the geological survey and a supplemental schedule of products is attached to the regular census schedule, which is turned over to the Geological Survey. There is no duplication of effort, no additional cost, and the census figures cover capital, wages, persons employed and materials used, which do not form a part of the data collected by the Geological Survey.

Mr. Brinton: I should like to get a symposium on the possibilities of getting additional and more frequent data in regard to manufacturers and it seems to me that the conditions have changed very materially in this country in the last few years, that we are now out of balance in the kind of available data. We have monthly data of exports—we can find out how many automobile tires are exported each month, but it is impossible to find out how many are made here. The same is true throughout the whole field of manufacture. It seems to me that agriculture is very well represented and not only by actual figures but by estimates. We have the estimates of the wheat crop for next year. To carry the simile further, we have no estimates of how many automobiles or how many trucks will be produced next year, though that is just as well known and easier to get. I think manufacturers are pretty well accustomed to making out questionnaires, and I think it would be bad to let them get back into the old habit of not sending in any information. I do not know that there is need of knowing the amount of manufactured products turned out and the growth of the manufacture of that product. Yet no one manufacturer of firearms is able to find out the number of paper shot shells in the United States, although there are only six or seven of them, and they cannot find out the game laws so as to determine whether there is any field for paper shot shells, and things of that kind that are really bread and butter to large industries. These people, it seems to me, deserve the same consideration comparable with the consideration that is being obtained by agriculture or the people doing export business. Manufacture, although it is a very large part of this whole country, is not at the present time properly represented, it seems to me. The facts have been worked out by the manufacturers as best they can by the formation of trade associations. I believe—though I have not got a great amount of figures—that the formation of these trade associations have been very largely due to the impossibility of getting any figures from the government on the whole industry. The trade associations have one basic weakness which the government has not got. The trade associations find it almost impossible to get all the members of the industry to come into the association. I do not think it ought to be necessary for the trade associations to get the figures for the whole industry.

MR. POTTER: I wish to discuss, briefly, points raised by Mr. Brinton and some of the others present. It seems to me that the point Mr. Brinton made that trade associations themselves are not able to collect this information is decidedly true. There is one reason that he did not give, moreover, why this is so. Many business men hesitate in peace times to give their competitors information regarding the volume of their output in dollars and cents or in articles. This reason makes it doubly desirable that the federal government extend its operations in the gathering of business statistics. Production figures should be regularly available at least for such basic raw commodities as steel, copper, coal, petroleum, cotton, leather, and wool. The logical agency to collect this information, it seems to me, is in the manufactures branch of the Census Bureau.

The Central Bureau of Planning and Statistics, which, through Dean Gay, has had contact with all the war boards where during the war most of these production figures have been developed, is planning to call together the heads of the statistical branches of these war boards with the officials of the census and other agencies particularly interested, to consider which of the manufactures statistics gathered during the period of the war should be continued and how they should be gathered. Those connected with these statistical agencies have all been so busy getting out information for the Peace Conference that the calling of this conference has been put off for a little while, but I am sure it is going to be given very definite consideration in the near future.

I should like also to bring up a matter related to my paper this morning. I suggested that the Central Bureau of Planning and Statistics should be continued for two purposes: first, as a clearing house of statistical information; and second, in order to develop progress reports for the President as a means of administrative control. The director of the census this afternoon suggested that the Census Bureau was considering the function of a clearing house as part of the work of his bureau.

If the Central Bureau of Planning and Statistics is continued it seems to me that the function of clearing information and of standardizing statistical practice might be more effectively performed there than in a bureau that is part of one of the regular departments of the government. A bureau of any regular department of the government is handicapped in attempting to standardize the processes of other departments or bureaus. If the Central Bureau is not continued as an independent agency, however, the Census Bureau would seem to be the proper and logical place for the clearing house function, while the Efficiency Bureau would seem to be the proper and logical place for the preparation of progress reports.

MR. HATHAWAY: Mr. Potter, you say the progress reports should be continued. Under what necessity and what authority of law would you expect that to be done on a peace time basis? We have never had anything similar to that to my knowledge heretofore, except as the reports come up through the various bureaus through the department heads to the President.

MR. POTTER. I do not believe there is any authority of law at the present time, but I think there should be. The point I made this morning is that we have such a large administrative organization in Washington that the chief executive can never hope, through personal contact, to keep track of its many activities. If we are going to have central administrative control and do away with the development of bureaucracy —independent agencies without central supervision—it must be done through effective reports to the President of the operations of departments, similar to those which have been developed as a result of necessity during the war. The Central Bureau ought to be continued as the "Information Service" for the general manager of our government, who is the President.

MR. HATHAWAY: Assuming that such a Central Bureau would not have any compiling functions itself or original investigations and all of these things that you are planning to save by distributing around through the various departments such as the Census Bureau and so on, would you not get into conflict in these special progress reports with the regular reports that are required by the executive through his departmental heads down through the bureaus?

MR. POTTER: No. These reports which have been developed during the war have, for the most part, been based on the reports made by bureau heads and department heads. The Central Bureau has simply collected these together, checked them for accuracy and reduced them in volume for presentation to the President. The Bureau has also developed such reports in branches where none existed. In the Navy Department, for instance, there was no central report from the various bureaus bringing together all the information regarding the activities of the different bureaus. Such a report was developed by the Central Bureau, however, and now the Navy Department, realising its value, is taking it over and developing it in the department. The function of the Central Bureau in regard to these "progress reports" is to see: (1) That they are obtained from the departments with sufficient frequency, to serve as a means for administrative control; (2) that uniform methods are followed as far as possible in their preparation; (3) to see that they contain not only a report of the good things done, but also of things not so favorable; and (4) to boil them down into brief space for presentation to the President. These are the functions the Central Bureau performed during the period of the war.

I have a very strong feeling that if these reports had been developed sooner we might have avoided some of the serious difficulties the administration had to face during the war. If, for example, the chief executive had known, from month to month, the real progress in aircraft production, the probability is the program never would have gone so far astray. It was lack of information in the hands of the chief executive of the country that permitted such a condition, not only to exist, but to continue until it reached the scandal stage.

A MEMBER: I would like to ask Mr. Potter if he has thought out the number of men in Washington who would have access to the data of this Central Bureau. For instance, whether the Congressmen would have access continuously without having a committee appointed for investigation purposes.

MR. POTTER: No, I think not. I think these reports, if they are going to be effective, must be the confidential reports of the administration for administrative purposes. If they were made public all reporting on undesirable conditions would immediately cease and the reports would become what departmental reports are at the present time—simply political propaganda of the accomplishments of the administration.

MR. CLARKE: I would like to ask Mr. Potter how far the activities of the Central Bureau of Planning and Statistics had inquired, and how far he thinks if it is continued it should inquire into the work of these departments and whether it is intended that the Central Bureau should exercise the sort of function that an auditor from the outside exercises over the accounting department to see if the reports are in harmony with the facts.

MR. POTTER: The function of the Central Bureau should be exactly the function of the assistant to the general manager of a business, who reviews the reports of the various departments, goes back and gets additional information if it is required, and insures that those reports present a real picture to the general manager of the operations of each of the branches of the organization. It is the duty of the Central Bureau to see that the President gets a clear and correct report. If the bureaus develop such reports themselves, Central merely passes them along, after combining them in a way that presents a brief and unified picture of governmental activities.

Mr. Clarke: If you saw anything suspicious you would check it up?

Mr. Potter: Absolutely. We were suspicious of some of the army requirement figures. We asked them what they meant, and partly as a result of that inquiry a revision was made. With a reasonable amount of tact in handling such matters I think it is possible to develop a system of dependable progress reports throughout the government that will give the chief executive of the government real administrative control over his machine. The combined progress report which the Central Bureau had developed before the armistice was signed, covered in twenty-six pages of graphs, tables and digested statistics, the most important activities of the war.

A Member: It seems to me that that is an excellent argument for having this work carried on by an organization that is not under the operation of any department. It really is an independent function.

The Chairman: That is probably why Mr. Potter suggests that if the Central Bureau be not continued this work might go to the Bureau of Efficiency, which has no departmental affiliation.

Mr. Rossiter: I am in hearty accord with what Mr. Potter has been saying. Mr. Potter and I have been actively at work on this sort of thing for several months and probably we have an especially keen appreciation of the value of the work. I arose to say that I doubt very much if legislation is necessary for what Mr. Potter has been describing. It is doubtful, indeed, whether legislation could be obtained for it. If the President of the United States is sufficiently impressed with the value of this sort of thing there would not be the slightest difficulty in obtaining it. I am inclined also to believe that a step has really been made in that direction by the Central Bureau. Mr. Potter has pointed out the fact that some of our reports have attracted the favorable attention not only of the executive office but of the departments themselves. If officials believe that a general manager's report is a good thing, they merely need to take the necessary steps to see that it is continued. It is not a question of whether information exists. Of course it exists in some form. The other day at the Navy Department that very question came up. The data are always in the department, but such information lodges in little nooks and crannies from which it is frequently extracted only for the annual report. As to the personnel of the navy, from time to time you could obtain always the number of men floating, the number in the reserves, and the number in the barracks. The secretary of the navy, for example, can obtain data relating to personnel if he asks for it, but if he does ask for it he gets it from the different bureaus, operations, navigation and marine corps that have the material in various forms. It is perfectly evident that, if such material is obtained periodically and put in the form of good tabular statements so that it is comparable from month to month, the secretary would begin to get an impressive picture of the personnel of the navy. The Navy Department already is taking up the problem of obtaining monthly a general manager's report. If the other departments would simply do that, and then permit the Central Bureau to have the material, it could very easily be turned into such shape that it would become a periodic presentation to the President of basic data in form comparable with what has been prepared before. Legislation is not necessary. The sentiment of the different departments ought to work toward that end, and an excellent beginning has been made by the Central Bureau of Planning and Statistics, but if, as suggested, that bureau goes out of existence possibly the census might take up that part of the work. This seems to me to be possibly one of the things accomplished as a result of war activities; if the Central Bureau has made a start in the direction of a general manager's report it may ultimately become of the greatest importance.

MAJOR HUNTINGTON: Something has been said of the work of the navy. I think it might be proper to mention in this connection that the army has been for many months preparing a weekly report very much of this sort for the benefit of Secretary Baker and that this report has been very much appreciated by Secretary Baker. It goes to him every Saturday night and he never leaves the building until he gets it actually in his hands and takes it home to read over Sunday. It is an executive's report, of about sixty pages, very much along the lines that have been described by Mr. Potter. And another thing that might be proper to mention; Mr. Potter spoke, I think, of the value of the work of the Central Bureau in stimulating the production of reports where the value of the things in those reports had not been altogether appreciated. That is exactly what has taken place in the War Department also. A number of indispensible reports have been prepared by the various staff corps and departments, solely at the instigation of the Statistics Branch, General Staff.

I have with me samples of the no longer very secret communications from the War Department to Secretary Baker; semi-monthly reports of personnel, weekly reports of things in general and reproductions of war charts, the form and get-up of which I think might be interesting to some of you.

THE CHAIRMAN: If no one else desires to take part in the discussion, we will stand adjourned to reassemble at 8 o'clock for our annual business meeting, which will be the last session of this convention.

ADJOURNED at 5 p. m.

PROCEEDINGS OF THE 80TH ANNUAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION, RICHMOND, VA., DECEMBER 27-28, 1918.

PROGRAM.

FRIDAY MORNING.

9.30-11.00. Robert E. Chaddock, presiding.
Analysis of the Standard of Living in the District of Columbia in 1917. W. F. Ogburn.
Discussion: E. A. Goldenweiser.
How to Figure Labor Turnover. F. L. Crum.
Discussion: Paul F. Brissenden.
11.00-12.30. Price Levels (Joint Meeting with the American Economic Association).
Price Fluctuations during the Present War. W. W. Stewart.
Discussion: Jacob H. Hollander.
The Possibility of Working Out an Index of the Cost of Living. Royal Meeker.

FRIDAY AFTERNOON.

2.30-4.30. Joseph A. Hill, presiding.
Statistical Technique in Individual Psychology. Beardsley Ruml.
Discussion: E. E. Day.
Our Statistics of Foreign Commerce and the War. Chauncey D. Snow.
Discussion: Carroll W. Doten.
An Examination of the Plan and Scope of Vital Statistics Education. Louis I. Dublin.
Discussion: Dr. John S. Fulton.
Some Essentials of Family Statistics. Edwin W. Kopf.
Discussion: H. H. Hibbs, Jr.

FRIDAY EVENING.

8.00-10.00. Presidential Addresses.
A Primary Culture for Democracy. Charles H. Cooley, American Sociological Society.
Statistics and Government. Wesley C. Mitchell, American Statistical Association.

SATURDAY MORNING.

9.30-12.30. Henry R. Hatfield, presiding.
The Statistical Work of the War Boards.
The War Industries Board. Leo Wolman.
The War Trade Board. Arthur E. Swanson.
The Shipping Board. Horace Secrist.
The Central Bureau of Planning and Statistics. Z. L. Potter.

SATURDAY AFTERNOON.

2.30–5.30. Wesley C. Mitchell, presiding.
Round Table Discussion of Federal Statistics.
W. S. Rossiter,
W. A. Hathaway,
N. I. Stone,
E. F. Gay,
W. F. Willcox,
Davis R. Dewey,
Hon. Sam L. Rogers.

SATURDAY EVENING.

8.00–10.00. Business Meeting. Election of Officers, Reports of Committees, etc. What action, if any, ought the Association take with reference to the reorganization of Federal Statistics?

MINUTES OF THE BUSINESS MEETING.

Meeting called to order at 8 p. m., December 28, 1918, President Wesley C. Mitchell presiding.

The reading of the minutes of the previous annual meeting was dispensed with, since they had been published in the March number of the QUARTERLY PUBLICATIONS. Minutes of two regular meetings of the Board of Directors, held January 11, 1918 and October 2, 1918, were read and approved.

Reports were submitted as follows:

SECRETARY'S REPORT.

Mr. President and Members of the Association:

I have the following report in respect to the condition of the Association:

New members added 1918	104
Deaths reported during the current year	8
Resignations reported during current year	21
Total deductions	29
Net gain for year 1918	75
Membership December, 1917	737
Present membership, December, 1918	812
Besides members we have:	
Subscribers, (mostly libraries)	246
Domestic exchanges	40
*Foreign exchanges	73
Total	1,171

*NOTE:—During the year war conditions caused us to discontinue 43 foreign exchanges, mainly to those countries at war with the United States. These are excluded from the above total.

The death of the following members has been reported during the year: Samuel A. M. Green, W. H. Timlin, Mrs. Mary M. Kehew, E. A. Riley, Isaac N. Seligman, Robert Campbell, G. E. Fuller, C. C. James.

Four numbers of the Quarterly Publications have been issued, containing an aggregate of 308 pages. The December number had not yet been mailed to the members at the date of this report.

Secretary's Report on Memorial Volume.

1. Account with the Rumford Press for publication, 1000 copies for Macmillan Company and 200 copies for members, etc...	$2,727.75
Payments to Rumford Press on account...	2,200.00
Balance due	$527.75
2. The Treasurer, during the year, authorised by the Board, borrowed $1,500, depositing, as collateral, securities owned by the Association	$1,500.00
3. Special offer to members at $3.50 per volume. Resulted in 173 cash orders. A number of members paid the full price, $7.50. Total receipts	665.00
4. Receipts to October 22, 1918, under Macmillan contract	244.16
5. Total receipts from sales to date	$909.16
6. Debt outstanding on volume	$2,027.75

The volume is now on sale through the Macmillan Company at $7.50 per copy.

Respectfully submitted,

Robert E. Chaddock,
Secretary.

On motion, report of Secretary accepted, and publication in the March number of the Quarterly authorized.

Treasurer's Report for 1918.

RECEIPTS.

Membership dues	$1,305.10	
Sales and subscriptions	676.98	
Dividend on B. & A.	178.08	
Balance on hand	727.63	
Loan made February 2, 1918	1,500.00	
		$4,387.79

EXPENDITURES.

Printing	$3,083.92	
Postage	200.21	
Salaries	627.10	
Expenses	293.21	
Balance forward	183.35	
		$4,387.79

ASSETS.

17 shares Boston & Albany R. R. stock @$135 per share. Loan of $1,500 at N. E. Trust Company on above stock still outstanding.

S. B. Pearmain,
Treasurer.

December 24, 1918.

Treasurer's Report, 1918, Memorial Volume Fund.

RECEIPTS.

Cash received	$915.21	
Interest on deposit	1.26	
		$916.47

EXPENDITURES.

Rumford Press for printing	$846.80	
Mr. John Koren	50.30	
Eaton & Gettinger bill	11.95	
Dues, sent in with checks for the Fund, which should have been credited elsewhere	6.00	
		$915.05
Balance on Memorial Fund		$1.42

S. B. Pearmain,
Treasurer.

December 24, 1918.

AUDITORS' REPORT.

BOSTON, December 24, 1918.

We have this day audited the accounts of the Treasurer of the American Statistical Association, and find them correct and properly vouched for.

LEROY D. PEAVEY.
ROSWELL F. PHELPS.

On motion the reports of the Treasurer and Auditors were accepted and ordered published in the proceedings.

JOINT FEDERAL STATISTICS COMMITTEE ON CENSUS.

President Mitchell announced the appointment of three representatives from our Association, on a joint committee of the American Economic Association and the Statistical Association, requested by the Director of the Census and the Secretary of Commerce, for the purpose of advising and aiding in matters connected with the approaching Census, as follows: W. S. Rossiter, C. W. Doten and E. F. Gay. It was announced that the Economic Association had named, as their representatives, E. R. A. Seligman, W. F. Willcox, and W. C. Mitchell.

REPORT OF THE COMMITTEE ON MUNICIPAL STATISTICS.

The Committee on Municipal Statistics, through its Chairman, Dr. L. G. Powers, submitted the following report:

"Your committee on Municipal Statistics, with the object in view of securing more comparable statistics of municipal and other governmental indebtedness, and the publication of such statistics at times more nearly approximating to the dates to which they relate, submit the following resolutions for adoption:

"*Resolved,* That the members of the American Statistical Association recommend the annual preparation of municipal and other governmental debt statements as of the close of the calendar years. This to be in addition to the preparation of such statements at the close of fiscal years, when such fiscal years do not coincide with the calendar years.

"*Resolved,* That printed copies of these resolutions, together with the following brief statement of reasons for the preparation of the specified debt statements, and the exhibited feasibility of their preparation be sent to the fiscal officers of our state governments and of American municipalities having a population in excess of 30,000.

"With few exceptions, the only debt statements which are now available as the basis of general statistics by the Bureau of the Census, or others, are those prepared as for the close of fiscal years. As a result of this situation, all compilations of comparable debt statistics are for dates which differ as much as twelve months and are not thus strictly comparable. Further, every publication includes some data that are for dates two years prior to the date of publication.

"If all cities and other governmental bodies prepared debt statements as for the close of the calendar years as here suggested it would be possible for the Bureau of the Census, the Financial Chronicle and other bureaus and agencies for publishing general debt statistics to collect by mail all the data required for their publication. The statistics compiled under the circumstances stated would be more comparable than any now available, and their preparation would involve but a fraction of the cost now required for the debt statistics of the National Bureau of the Census. Further, the statistics published would be in the hands of the public from one to two years sooner than is now possible.

"It is doubtful if all municipalities and other governmental organizations can ever be induced to adopt identical fiscal years and bring about strictly comparable statistics in that way. The only way attainable for securing those statistics is by the method here suggested. Further, the preparation of such debt statements as is here suggested is practicable, since the city of New York and some other municipalities now prepare monthly debt statements.

"The desirability of preparing debt statements as for the close of calendar years was recognized by the National Association of Comptrollers and Accounting Officers at their 13th Annual Convention at Atlantic City, N. J., June 21, 1918, by the following resolution:

"*Resolved,* That the members of this association place themselves on record as strongly in favor of preparing for their respective cities, an annual debt statement at the end of each calendar year, in order that the National Bureau of the Census can quickly collect and distribute brief summaries of municipal indebtedness as soon after January first as possible.

"Your committee further recommends that the Secretary of this Association be instructed to send a copy of the resolutions and statement of facts above given to the Director of the Census, respectfully requesting that brief statistics of debt be collected by mail from as many cities as will prepare the same for December 31, 1918, and that these be published and distributed at as early a date as practicable. The publication will at first be for not more than 60 or 70 per cent. of the cities, but the desirability of the given statistics, published promptly after the close of the year will in a few years lead all cities and other governmental bodies to prepare the required statement and open the way for other lines of comparable statistics."

On motion the Association approved of the first resolution embodied in the above report, and authorized the Secretary to communicate with the Director of the Census, urging him to consider the feasibility of the procedure recommended and to take such steps as he may deem wise to secure these results.

REPORT OF COMMITTEE ON BUSINESS STATISTICS.

W. A. Hathaway, Chairman, presented the following report for the Committee:

"The following are the recommendations of the Committee on Business Statistics:

"1. Corporate memberships with annual dues of $100.

"2. To do further work on the survey on the scope, method and source of statistical data compiled and used by industrial and commercial concerns and which appear in various financial and trade magazines, etc. Some preliminary work on this was done in the year 1916 (see attached copy of Preliminary Report of the Committee made at the Columbus meeting) but considerable more work can be done on this job and possibly a report prepared that will be of general value and interest, if the Association thinks it worth while.

"3. The committee recommends that the Association foster and promote the instruction of statistics in our educational institutions, with particular reference to business needs and also to encourage the compilation of better textbooks. In this connection, the committee calls attention to the possibility of introducing elementary instruction in statistics and graphics in the lower grade public school textbooks.

"4. The committee recommends that the Association arrange, through its Secretary, to have a statistical study of the membership of the Association made, preferably by some class in statistics in some university, at no expense to the Association, this study to analyze the membership by occupation and industry, geographic location, etc., and to be brought up to date annually or biennially for the purpose of showing growth, progress, distribution, etc.

"5. The Committee asks authority or approval of the Association to supervise the collection and deposit of conspicuous pieces of statistical work of an original and research nature, both Government and private, in some public library, such as the New York City Public Library, provided such a collection can be effected without cost to the Association. Some preliminary inquiries have been made with the New York Public Library which tentatively agreed to provide a suitable room for such a collection and to index it, from which copies could be secured by members of the Association by the payment of a small reproduction fee.

"6. The committee recommends that the Association go on record as favoring the establishment of a central statistical agency in Washington, to supervise and coördinate all Government statistical work, one of the functions and needs of such an organization being to foster the preservation and possible publication of the statistical products of the various war agencies and, if feasible, to arrange for the continuation of such of these statistical reports as may be considered desirable in peace times. The committee makes no recommendation as to how this central statistical agency should be accomplished, but suggests that the Association appoint a special committee to investigate and make further recommendations to the Association, this special committee to coöperate with all other organizations and Government departments in working out such a centralized scheme. The committee here desires, however, to express a word of limitation on this recommendation to the effect that it is made on a purely statistical basis and has not to do with the establishment of any agency of a non-statistical nature."

On motion, the Association approved the recommendation of the committee that provision be made for a new class of members, to be called corporate members, with an annual membership fee of $100. The other recommendations of this Committee were referred to the Board with power. To render effective the above action of the Association, and following action at the annual business meeting in 1917, at which an amendment of Article III of the Constitution was proposed and favorably acted upon providing for this new class of corporate members, Article III of the Constitution was finally amended to read, "regular members, fellows, *corporate members*, and honorary members."

Section 2 of the By-Laws, which regulates the dues of the members, was amended by the required two-thirds vote of those present, to read: "Each regular member shall pay annual dues of *three* dollars, or *thirty* dollars at some one time, each fellow shall pay annual dues of five dollars, or fifty dollars at some one time, and *each corporate member shall pay annual dues of one hundred dollars.*" The Association approved the action of the Board October 2, 1918, raising the subscription rate for the QUARTERLY PUBLICATIONS to *three dollars per* year, beginning with the year 1919.

REPORT OF NOMINATING COMMITTEE.

The report of the Nominating Committee, consisting of W. A. Hathaway, F. S. Crum, and A. A. Young, which had been sent to the members of the Association in accordance with the provisions of the constitution, was presented for action. The Secretary was instructed to cast one ballot for the persons placed in nomination by the committee, with the one exception of Treasurer. Mr. S. B. Pearmain requested the Association to relieve him of his duties as Treasurer. The following officers were declared elected: President, Joseph A. Hill; Vice-Presidents, Willard C. Brinton, Carroll W. Doten, Willford I. King; Counsellors, Wesley C. Mitchell, Frederick L.

Hoffman, Walter F. Willcox; Secretary, Robert E. Chaddock; Librarian, Horace L. Wheeler; Editor, John Koren. The Association then proceeded to the election of a Treasurer. Robert E. Chaddock was elected, thus combining the duties of Secretary and Treasurer under the direction of the same person.

The Association voted to appropriate $600 for assistance for the Secretary-Treasurer, this sum to include such amounts as have been heretofore granted to the Secretary and to the Treasurer for this purpose.

Consideration of the problem of adequate compensation for the editor of the QUARTERLY PUBLICATIONS was referred to the Board with power.

The following resolutions were offered by Dr. F. L. Hoffman and approved by the Association:

Resolved, That the Secretary obtain from the Treasurer, or from other sources, a complete financial statement of all the receipts and disbursements having reference to the preparation, publication and distribution of the Memorial Volume, The History of Statistics, and,

Resolved, Further, that the report in question be published not later than in the second QUARTERLY PUBLICATION of the Association during the year 1919, with the information brought down to the end of the year 1918.

Since the chairman of the Committee on Fellows was unavoidably detained from the meeting, and since no other member of the committee was able to present the results of the final deliberations of the committee at the business session, the Association, on motion by Mr. Rossiter, authorized the Secretary to receive a list of the fellows elected by the committee for inclusion in the roll of fellows of the Association. The names are as follows: Kate H. Claghorn, John Cummings, William A. Hathaway and Horace Secrist.

The following resolutions were presented by Mr. James G. McDonald, representing the National Civil Service Reform League:

WHEREAS, the 1920 National census should be our most important single source for statistics vitally affecting our social and economic problems.

WHEREAS, the usefulness of this census will be in direct proportion to its accuracy.

WHEREAS, it is obvious that the enumerators and supervisors should be selected because of technical fitness.

WHEREAS, the pending Census Bill H. R. 11984, keeps the appointment of the supervisors, who name the enumerators, out of the control of the Civil Service Commission, and thus makes both supervisors and enumerators political.

WHEREAS, "political" enumerators have in the past often been incompetent and sometimes corrupt.

WHEREAS, a special committee of this Association is coöperating under the Director of the Census in the preparation of certain technical phases of the work.

We, the members of the American Statistical Association, respectfully but most earnestly urge that the supervisors be appointed through the agency of the Civil Service Commission.

Voted to lay the above resolutions on the table.

The By-Laws were amended by the necessary two-thirds vote to provide for a membership committee. Section 7 was added, which reads: "The Board of Directors, as soon as practicable after their election, shall appoint a membership committee of five members, with power to add to their number."

The following resolutions were presented in appreciation of the services of the retiring Treasurer and approved:

Resolved, that the members of the Association desire to express their very sincere appreciation to Mr. Pearmain, the retiring Treasurer, for his valuable and long continued services to the American Statistical Association, and their profound regret that, for private reasons, he should find it imperative to relinquish the duties of an office which he has filled in such an admirable manner, and to the full satisfaction of the membership of the Association.

Resolved, further, that the Secretary be instructed to transmit a copy of these resolutions to Mr. Pearmain, with the greetings and best wishes of the Association.

Mr. W. I. King offered the following resolution for consideration by the Association:

Resolved, that a Committee be appointed by this Association whose duty shall be to encourage the continuous coördination of *all* Federal statistics; such coördination to be secured through the medium of a *permanent* Federal Bureau of Statistical Standards, which shall have full power to harmonise and prevent duplication in the statistical work of *all* Government Departments.

The above resolution was referred to the Board with power.

Robert E. Chaddock,
Secretary.

MEETING OF THE BOARD OF DIRECTORS.

At a meeting of the Board of the American Statistical Association held at the Cosmos Club, Washington, D. C., January 14, 1919, the following appointments were made for the year 1919.

Committees were appointed as follows:

Federal Statistics: William A. Hathaway, chairman, Frederick S. Crum, Lewis Merriam, Wesley C. Mitchell.

Business Statistics: M. C. Rorty, chairman, Willard C. Brinton, Earle Clark, Edith M. Miller, Horace Secrist.

Membership Committee: Willard C. Brinton, chairman, Louis I. Dublin, Edward V. Huntington, Fred Macaulay, Robert M. Woodbury.

State Statistics: Charles F. Gettemy, chairman, Wilmer R. Batt, Fred C. Croxton, Frank H. Dixon, Hornell Hart.

Municipal Statistics: Adna F. Weber, chairman, Mills E. Case, Kate H. Claghorn, Stark M. Grogan, Louis N. Robinson.

International Statistics: Frederick L. Hoffman, chairman, Leonard P. Ayres, James A. Field, Hugh J. Wolfenden, Allyn A. Young.

Finance Committee: Geo. E. Roberts, chairman, Roger W. Babson, Robert E. Chaddock.

Library Committee: Edmund E. Day, chairman, Carroll W. Doten, Warren M. Persons.

Associate editors were appointed as follows: Reginald L. Brown, Earle Clark, Edmund E. Day, Raymond Pearl.

Assistant Secretaries were appointed as follows: Louise Stevens Bryant, Philadelphia, Pa., Julius H. Parmelee, Washington, D. C., Martin J. Shugrue, Cambridge, Mass.

Robert E. Chaddock
Secretary.

REVIEWS AND NOTES

UNIFORM STATISTICS OF MENTAL DISEASES IN THE UNITED STATES.

The American Medico-Psychological Association at its meeting held in New York, in May, 1917, adopted the report of its Committee on Statistics which provided for a system of uniform statistics in institutions for mental diseases, and appointed a standing Committee on Statistics to promote the introduction of the system throughout the country. This committee met in New York City on February 7, 1918, and in coöperation with the National Committee for Mental Hygiene outlined a plan of procedure.

The National Committee has established a Bureau of Uniform Statistics and has received a special gift to defray the initial expenses of the work of collecting statistics from institutions for the insane. As close relationships have always existed between the American Medico-Psychological Association and the National Committee, it was thought wise for the Bureau of Uniform Statistics of the National Committee for Mental Hygiene to have the work of introducing the new system and of collecting statistics from the institutions carried out by the Bureau.

In accordance with this arrangement, the Bureau, with the assistance of the Committee on Statistics of the American Medico-Psychological Association, has prepared this manual to assist the institutions in compiling their annual statistics and has printed a series of forms to be used in preparing statistical reports. The manual and duplicate forms will be furnished free to all coöperating institutions, and it is earnestly hoped that they will be generally adopted, so that a national system of statistics of mental diseases may become an actuality.

The manual gives instructions for the proper completion of the forms, with respect to the use of abbreviations, etc. On pages 12 to 29 a full display of the titles in the classification of mental diseases approved by the American Medico-Psychological Association is shown. A series of eighteen primary statistical tables is recommended for the systematic presentation of the data. The pamphlet is published by the Bureau of Statistics, National Committee for Mental Hygiene, 50 Union Square, New York City.

E. W. Kopf.

STATISTICAL STUDY OF THE INFLUENZA EPIDEMIC.

The American Public Health Association, Vital Statistics Section, appointed a Committee on Statistical Study of the Influenza Epidemic on November 20, 1918. Under the auspices of this committee, a meeting of the state and municipal registrars in the eastern states was held at the University of Pennsylvania, Hygiene Laboratory, Philadelphia, Pa., on November 29 and 30, 1918. There were present, also, at this initial conference, several private statisticians interested in the public health statistics of the epidemic and the results to be derived from study of such data. A series of suggestions was made up, mimeographed and sent to statistical and public health workers for criticism. At the meeting of the Vital Statistics Section in Chicago on December 11, the committee submitted a report on its activities and asked for authority to continue further inquiry into a program of statistical study of the epidemic. The section authorized the continuance of the committee and provided that representatives of the United States Bureau of the Census, of the United States army and navy, of the United States Public Health Service, of the state and municipal health boards, and the various, statistical, sociological, actuarial and economic associations be represented thereon. The committee was specifically authorised to act in an advisory capacity to outline first, the various sources of data, the minimum standards of tabular and registration practice to be observed by several organizations providing data, and second, to bring in recommendations on the pathometric or mathematical analysis of published epidemic data. The committee was divided into four sub-committees as follows:

Sub-Committee A: *Registration and Tabulation Practice of the Federal Departments.* (Wm. H. Davis, M.D., chief statistician, Division of Vital Statistics, Bureau of the Census, *Chairman;* Richard C. Lappin, *Recorder.*)

Sub-Committee B: *Registration and Tabulation Practice of the State Departments and Commissions.* (Otto R. Eichel, M.D., director, Division of Vital Statistics, New York State Department of Health, Albany, *Chairman;* Edwin W. Kopf, *Recorder.*)

Sub-Committee C. *Registration and Tabulation Practice of Municipal Boards of Health and of Private Public Health Agencies.* (Chas. Scott Miller, M.D., Philadelphia Department of Health, Philadelphia, Pa.

Sub-Committee D: *Pathometry* (mathematical analysis and interpretation) *of the Epidemic.* (Charles C. Grove, Ph.D., Columbia University, *Chairman;* Arne Fisher, F. S. S., *Recorder.*)

Mr. E. W. Kopf was delegated to act as chairman of the General Committee and to coördinate the work of the several sub-committees. The General Committee of the Vital Statistics Section was authorized to coöperate in statistical matters with the Influenza Reference Committee of the entire Association.*

FEDERAL STATISTICS.

At the Washington meeting of Sub-Committee A, the following subjects were taken up:

> Estimates of population: Obtaining estimates of army and navy populations by five-year age periods, through random sampling if necessary, but by direct tabulation of army and navy enlistment records if possible;
>
> Causes of death reported during the epidemic were to be classified in accordance with the Manual of the International List of Causes of

---

* *See* "Influenza Bulletin" *American Public Health Association,* Boston, Dec. 13, 1918.

Death and the Index of Joint Causes as published by the Bureau of the Census;

Infant mortality was to be studied in such manner as to show what part of this mortality was probably due to birth mortality arising out of influenzal illness of the mother and to the factor of neglect;

Norms of mortality during September, October and November were also considered.

It was also indicated that it was unwise to draw any conclusions from statistics of variations in bacterial flora at various stages in the epidemic or in different localities unless it was shown that all laboratory conditions had been properly controlled. The army was requested to supply statistics as to influenzal sickness classified by five-year age periods, by date of onset, by duration of illness in days, by principal complications, showing fatality or lethal rates for 100 completed cases.

STATE STATISTICS.

Sub-Committee B considered the more intimate statistics of the epidemic in the states. The sub-committee pointed out that in certain cities and for certain states valuable data was available in the back files which would lead to the determination of the norm of mortality during the fall and winter months of the year. The social statistics of the epidemic were emphasised. It was urged that statistics of the effect of the epidemic upon the family should be collected. State and municipal governments were urged to make preparations necessary for the proper statistical study of the epidemic data.

MUNICIPAL STATISTICS.

The Sub-Committee on Municipal Statistics discussed chiefly the available data in the files of maternity clinics and visiting nursing associations. It was indicated that thorough study of these records would bring out some of the important facts on the obstetrical data of the epidemic.

MATHEMATICAL STUDY OF THE EPIDEMIC.

The Sub-Committee on Pathometry has outlined for itself the problems of mathematically testing and graduating the crude compiled data for norms of infant and adult mortality. The sub-committee has in mind the frequency curves of mortality from the several important causes of death during the fall and winter months of the year, especially the curves for infant mortality considered as (a) "birth mortality" and (b) "true infantile mortality." By means of modern analytic methods it was aimed to determine the true "excess mortality" during the epidemic. It was planned also to fit various curves to the observed epidemic data, to compute the equations and the constants of the distributions in the several areas under observation (mean, mode, dispersion, skewness, "excess").

The Sub-Committee on Pathometry also anticipated that it could determine by delicate mathematical tests the *probable* date of the beginning, "peak" and ending of the several waves or phases of the epidemic in the various communities, and possibly, the approximate differential equations representing the several recurrences or recrudescences of the epidemic could be established.

METHODS OF INFLUENZA STUDY APPLIED IN PREVENTIVE MEDICINE GENERALLY.

The methods of higher analysis applied to the influenza epidemic data can be of service to preventive medicine in the study of other diseases. The profession of statistics is confronted with an opportunity for unparalleled service to the medical sciences, among them preventive medicine.

EDWIN W. KOPF, *General Chairman,*
Committee on Statistical Study of the Influenza Epidemic, Section on Vital Statistics, American Public Health Association.

NOTICE TO MEMBERS.

The list of the publications of the American Statistical Association, which hitherto have been printed in each quarterly number, has assumed such dimensions that it seems a waste of space to repeat it four times a year. Hereafter the complete list will be printed only once a year and reference made in each issue of the particular number in which the list if given. The last complete list is to be found in the December number and orders should, as before, be addressed to

MARTIN J. SHUGRUE, *Assistant Secretary,*
222 Charles River Road, Cambridge, Mass.

NEW SERIES, No. 126. (VOL. XVI.) JUNE, 1919

QUARTERLY PUBLICATIONS OF THE
AMERICAN
STATISTICAL ASSOCIATION.

I. THE OFFICIAL STATISTICS OF JAPAN.
II. THE ITALIAN FACTOR IN THE RACE STOCK OF ARGENTINA. By Robert F. Foerster.
III. HOW TO FIGURE LABOR TURNOVER. By Frederick S. Crum.
IV. ANALYSIS OF THE STANDARDS OF LIVING IN THE DISTRICT OF COLUMBIA IN 1916. By Wm. F. Ogburn.
V. NOTES ON PROFESSOR OGBURN'S ANALYSIS OF THE STANDARDS OF LIVING IN THE DISTRICT OF COLUMBIA IN 1916. By E. A. Goldenweiser.
VI. IS THE NEW IMMIGRATION MORE UNSKILLED THAN THE OLD? By Paul H. Douglas.
VII. NOTICE (MEMORIAL VOLUME).
VIII. REVIEWS AND NOTES: Cost Accounting, *Arthur R. Burnett.* Housing Standards in Brooklyn, *Earle Clark.* Annual Census of the Insane and Feeble-Minded, Epileptics and Inebriates in Institutions in the United States January 1, 1918.

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1919.

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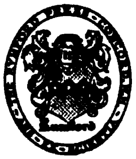

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 126. JUNE, 1919

THE OFFICIAL STATISTICS OF JAPAN.*

I. HISTORICAL.

The question of official statistics was among the first to be considered by the Japanese authorities, when the administrative organs were started anew on the Restoration of the Imperial régime (1868). In 1871, a section called the Seihyokwa (the Section of Political Tables) was set up in the Dajōkwan (the central office for general political affairs, now the Cabinet), and through its operation various statistics were compiled and published under the title of "Japan Political Tables." This section indeed was the first central organ of statistics created in Japan. The year 1881 saw the establishment of the Bureau of Statistics in the Dajōkwan, having for its general object to promote the statistical work of the government. But in 1885, when the government organization was remodeled, the Dajōkwan was replaced by the Cabinet, and the Board of Statistics was turned into the Bureau of Statistics, under the control of the Cabinet. In 1893, the Bureau was again reduced and placed under the Cabinet Secretariate as the Section of Statistics. In 1898, however, this section, coming under the direct control of the Cabinet, resumed the name of Bureau with its scope enlarged accordingly, and in this condition it has remained to this day. In 1918, a new institution, named the Temporary Census Bureau, was added to the Cabinet with the object of carrying out the First Census in 1920. The Bureau of Statistics, then, together with this sister establishment, may be said conjointly to form the central organs of statistics in the Empire.

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* This article, prepared under the direction of the chief of the Imperial Bureau of Statistics of Japan, was intended for our Memorial Volume, but was received too late to be included.

Besides these central bureaux, each prefectural office as well as each department of the government since the early years of the Meiji era (which begins with 1868) has been provided with a special organ for the purpose of collecting statistics on matters falling under their respective jurisdictions, and in this manner there has existed a definitely established system of statistics all over the country which has continued to develop up to the present time.

For Reference.

A. The Successive Heads of the Central Organs of Official Statistics.

Kōji Sugi, Chief of the Seihyōkwa of the Dajōkwan. December, 1871 to May, 1881.

Fumio Yano, Manager, Acting President of the Board of Statistics of the Dajōkwan. June, 1881 to October, 1881.

Shigenari Yasukawa, Manager, Acting President of the Board of Statistics of the Dajōkwan. November, 1881 to April, 1882.

Vicount Koyata Torio, President of the Board of Statistics of the Dajōkwan. (Lieutenant-General.) April, 1882 to December, 1885.

Shigetomo Ishibashi, Director of the Bureau of Statistics of the Cabinet. December, 1885 to November, 1893.

Shigetomo Ishibashi, Chief of the Section of Statistics of the Cabinet. (Secretary of the Cabinet.) November, 1893 to June, 1895.

Masahisa Motoyama, Chief of the Section of Statistics of the Cabinet. (Secretary of the Cabinet.) June, 1895 to February, 1897.

Naosaburō Hanabusa, Chief of the Section of Statistics of the Cabinet. (Secretary of the Cabinet.) February, 1897 to October, 1898.

Naosaburo Hanabusa, Director of the Bureau of Statistics of the Cabinet. November, 1898 to April, 1916.

Toratarō Ushizuka, Director of the Bureau of Statistics of the Cabinet. April, 1916–.

Count Hideo Kodama, President of the Temporary Census Bureau. (Chief Secretary of the Cabinet.) May, 1918–.

Toratarō Ushisuka, Vice-President of the Temporary Census Bureau. May, 1918–.

B. The Membership of the Central Organs of Official Statistics (including additional posts).

	Chokunin rank.	Sōnin rank.	Hannin rank.	Employees.	Total.
Dec. 30, 1871			4		4
Dec. 31, 1875		1	23		24
Dec. 31, 1880		2	18		20
Dec. 31, 1885	1	7	23	27	58
Dec. 31, 1890		1	?	?	?
Dec. 31, 1895		1	20		21
Dec. 31, 1900	1	3	22	50	76
Dec. 31, 1905	1	3	16	80	100
Dec. 31, 1910	1	5	14	145	165
Dec. 31, 1915	1	3	13	124	141
Dec. 31, 1917	1	3	12	131	147

II. THE PRESENT SYSTEM OF STATISTICAL ORGANIZATION AND WHAT IT HAS ACHIEVED.

(1) The present central and local organs of official statistics are composed of the following members and do statistical work within their respective spheres:

The Cabinet.

The Bureau of Statistics. Director, statisticians (the above are of higher ranks), assistant statisticians, minor officials and employees.

The Temporary Census Bureau. President, vice-president, secretary, statisticians (the above are of higher ranks), assistant statisticians, minor officials and employees.

Each Department of the Government. Superintendent of statistics (higher rank), minor officials and employees.

The Hokkaidō Administration Board and each Prefectural Office. Superintendent of statistics (*hannin* rank), minor officials and employees.

(2) The present central, departmental and prefectural organs of official statistics have, respectively, the following statistical functions:

The Cabinet.

The Bureau of Statistics.

a. The unification of statistics collected by various departmental and prefectural offices.

b. Collecting statistics of the population, and other statistics not belonging to any individual administrative department, namely, those relating to the state of the population (prepared every fifth year), the movement of the population and the causes of deaths (prepared every year), compiling the Statistical Year Book and the Summary of Statistics every year, and occasional investigations and compilations of miscellaneous statistics.

c. Exchanging statistical publications between Japan and foreign countries.

d. The convocation of the superintendents of statistics of departmental and prefectural offices, and holding conferences.

The Railway Board.

Collecting statistics concerning state railways, private railways, light railways and tramways.

The Department of Foreign Affairs.

Collecting statistics relating to the Japanese subjects living abroad.

The Department of Home Affairs.

Collecting statistics concerning Shinto shrines, local administration, elections, police, public works, sanitation, geography, copyright, charity and relief.

The Finance Department.

Collecting statistics regarding finance, accounts, taxes, national loans, currency, deposit money, custody, banking, trust and mutual financing.

Collecting statistics relating to tobacco, salt and camphor and statistics relating to imports and exports and transportation to and from oversea dominions.

The War Department.

Collecting statistics concerning the army.

The Naval Department.

Collecting statistics concerning the navy.

The Department of Justice.

Collecting statistics respecting civil cases, criminal cases, voluntary jurisdiction, census registration, prisons, the protection of discharged prisoners and other judicial functions.

The Department of Education.

Collecting statistics relating to education, science, art and religion.

The Department of Agriculture and Commerce.

Collecting statistics relating to agriculture, commerce and industry, marine products, forestry, mining, geology, and the enforcement of the Factory Law.

The Department of Communications.

Collecting statistics concerning the post, parcels-post, telegraph and telephone, nautical marks, hydraulic power for electricity, electrical business, shipbuilding, land and marine transportation, sea-routes and sea-men. Collecting statistics relating to postal money orders, postal savings, postal life insurance, the payment of pensions and annuities, receipts and payments made on behalf of government offices.

The Chōsen Government-General.

The Taiwan Government-General.

The Karafuto Administration Board.

Collecting statistics relating to the work of their respective jurisdictions.

The Hokkaidō Administration Board and each Prefectural Office.

Collecting miscellaneous statistics relating to the affairs within their respective jurisdictions.

(3) Each government office in the empire has annually published books of statistics compiled by its own statistical organ. As to those issued by the central organ, a brief note will be given later under the head of "Publications."

(4) The following are the principal results hitherto attained by the central organ of statistics:

In the early years of Meiji, the government prepared a plan of census-taking which was to be extended over the whole country. By way of experiment, it caused, at the end of 1879, the entire province of Kai (identical with Yamanashi Prefecture, one of the present administrative divisions) to be brought under census-taking by the modern method, and the results were arranged and published later by the Board of Statistics.

In 1902, the Law of Census (Law no. 49 of the same year) was promulgated.

In 1903, an estimate was presented to the Imperial Diet for carrying out the first census in the empire in 1905, but the scheme was cut short by the dissolution of the Diet.

In 1910, the Preparatory Census Committee was instituted as an advisory organ to the prime minister with respect to the projected first census, and it continued to 1913.

In 1917, an estimate was presented to the Imperial Diet for the first census to be taken in 1920, and the parliamentary approval of this gave rise to the establishment of the Temporary Census Bureau in the following May. Chōsen, Taiwan and Karafuto also, with their own estimates passed, set up special organs in order to participate in the Imperial census-taking.

(Note: Though the above-mentioned census-taking is a matter of the future, it is one which has formed such an important problem since the foundation of the central organ of statistics that its mention here seems appropriate.)

(5) Among the affairs dealt with by the central organ, the international relation of statistical work is a matter which, from the first, has received particular attention. Thus in 1875, at the International Congress of Statisticians held at Budapest, our empire was represented by the French statistician, M. Block Maurice, while to every Conference of the International Institute of Statistics held since 1899 we have sent a delegate, the names of the delegates being Count Y. Yanagisawa, Dr. N. Hanabusa and Dr. I. Takano.

III. THE PROSPECT OF OUR OFFICIAL STATISTICS.

With the progress of time, the public business and enterprises in the empire have become more and more complicated and diversified, and consequently our official statistics have increased remarkably in scope as well as in detail.

In view of the present conditions, it is undoubtedly of vital importance for us to be constantly supplied with accurate and well-founded calculations of all the elements of the national power, in order that whatever we may project or put in operation may be based upon the exact knowledge thus obtained of the full extent of our national resources.

If we turn our eyes, however, to the existing system of our official statistics, we find it far from adequate to the requirements of the day. Outside a few classes of statistics relating to the movement of the population and to factories, our central organ is scarcely equal to undertaking itself that indispensable observation of units which lies at the bottom of all statistics, and since much of the investigation and tabulating work in that line is left to the lower administrative organs, we can not expect to see any high degree of accuracy or unity in the results thus produced, but must often be contented with the supply of rough and imperfect information. On the other hand, our central organ is deplorably limited in its function by the fact that the greater part of the statistical work in the empire is divided among and put in charge of various government offices.

Obviously, this tends to produce a lack of interrelation and uniformity among different parts of the statistical work, not to speak of the financial disadvantages which are inevitable under such circumstances.

It is needless to say that, in order to remove these obstacles to a fruitful conduct of our statistical work, the first step to be taken is the expansion of the central statistical organ. It must be reorganized on an enlarged scale and made competent to build up a well-ordered, consistent system of statistics by gradually drawing to itself that part of the work which now is in the hands of various offices and needs to be centralized. As to the methods of investigation and tabulating, there must be a fundamental reform, in accordance with the requirements of science.

THE PUBLICATIONS BY THE CENTRAL ORGAN OF STATISTICS.

Japan Political Tables, annually issued from 1872 to 1880. The contents were as follows: Foreign Trade, Government Officials, Police, Justice, Hereditary Stipends and Rewards, and the Population.

(NOTE: In the early years of Meiji, "Seihyō" [political tables] was our term for statistics.)

Tables of Prefectural Finance, issued annually from 1875 to 1880.

Imperial Statistical Year Book, issued annually since 1882.

Summary of the Imperial Statistics, issued annually since 1887.

State of the Population of the Empire, issued every fifth year since 1898.

Movement of the Population of the Empire, issued annually since 1899.

Statistics of the Causes of Death, issued annually since 1906.

Besides the above-mentioned, there are dozens of publications issued occasionally since 1899, including statistical material mainly concerning the population, and the results of the study and discussion of miscellaneous statistics.

THE ITALIAN FACTOR IN THE RACE STOCK OF ARGENTINA.

By Robert F. Foerster.

That there is a large colony of Italians in Argentina and that it has played a striking part in the Argentine economic development are facts widely, if vaguely, understood. But that the Italian population, or let us rather say, the Italian strain, has been preponderant in some important sections of the country, and in the whole land has been second only to the Spanish—at least half as large as the Spanish—has not been appreciated. Statistical data of great interest exist to show, approximately, what the strength of the Italian factor is. Since figures equally discriminating are very rare in the records of the newer countries, it is the more worth while to study these data. It is likely, in fact, that the demographic developments which have taken place upon a large scale in Argentina have many counterparts among Italian (and other immigrant) colonies elsewhere.

Of the importance of Italian blood in the first half of the nineteenth century it is difficult to speak. There were groups of Italians in Buenos Aires, in Rosario, and about the rivers. Probably they intermarried little with the older stock, and probably they had numerous children—already designated, by the fact of their American birth, as Argentines.

Had the meager first census of 1857 specified nationalities, it would have shown an appreciable Italian element. It gave only an admittedly incomplete guess (liberal, however, as far as it went), of the population of the country; and the lacunae were filled out in 1860 by another guess, and the total proclaimed as 1,210,000.* Of these the Italians and their children were certainly not less than 1 per cent. and presumably not more than 2 per cent.†

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* República Argentina, *Segundo censo*, Vol. II, p. xvi.

† In a volume dealing comprehensively with Italian emigration and its problems, shortly to be published, I have given some particulars regarding this and later periods which do not appear in the present article. On the other hand, the computation and almost the entire evidence here detailed are omitted from the book.

Very interesting is the contrast of the census figure just quoted with that for immigration between, say, 1857 and 1910. In this period, four and one-half million immigrants, in round numbers, entered the country, of whom perhaps two and one-half millions or more did not again depart from it. Between 1857 and 1869 about 150,000 immigrants came, of whom more than 100,000 were Italian. In 1869, the population (without Indians), according to what has been officially designated as the first census, was 1,737,076. Of these, 201,292, or 12.1 per cent., were foreigners, mainly Europeans, and largely Italians. But included in the Argentines were the descendants of the earlier Italians and the native children of those who had come since 1857. From many sources it is clear that the settlers had large families.

Twenty-six years elapsed before another census was taken—the latest national census. Then (1895) the population was 4,044,911, an increase of 121 per cent., or 2,307,835. More than 800,000 Italians had meanwhile arrived, the total being reduced, by death and emigration, to 492,636, in a total foreign population of 1,004,537. The "Argentine" population, however, of 2,950,384, included the living children of the Italian population of 1869 and of the immigrants arrived after that date. Did the descendants of the Italians number 350,000? If for the moment we may suppose so, then the Italian strain of 850,000 persons was about one third as large as the 2,600,000 of the older Argentine stock and the descendants of non-Italian immigrants. In 1895 non-Italian foreigners numbered 501,891, but little more than the Italians; their descendants may have been as numerous as the Italians'. Then twice 850,000 or 1,700,000 was the population of foreigners and their native children, while the older Argentine population was 350,000 less than 2,600,000 or 2,250,000. Then, of the total population, the foreign factor was 43 per cent. and the old native population 57 per cent. Between 1895 and 1910 the net immigration (excess of immigrants over emigrants) was about 1,400,000; of which the net Italian immigration was about 700,000. Between those years, the stocks of 1895, by excess of births over deaths, might have been increased 50 per cent.—the foreign to 2,550,000, the Argentine to 3,375,000.

The foreign, however, in consequence of an additional immigration of 1,400,000, would have risen further, to 3,950,000; and still further, through the excess of births over deaths of the new immigrants of these fifteen years, say to 4,200,000. Then, by 1910, there would be a population of 7,575,000 (a figure not far from the estimates of recent years), of which the old Argentine stock would be 44 per cent. and the foreign 56 per cent. And the Italians, since they were half the foreigners of 1895 and half the newer immigrants, might be 28 per cent. of the total.

These are impressive results. But can they be justified? There is a doubt concerning the amount of the native-born foreign stock of 1895, and a doubt concerning the assumption that the rates of reproduction of Argentine and immigrant factors were equal. What follows does not finally deal with these doubts, but it suggests that, at the least, if the first estimate overstates the foreign factor, the second understates it, and the net conclusion must be not far from that suggested.

In the city of Buenos Aires, in the five years 1860–1864, there were 2,092 marriages of Argentine men with Argentine women, 758 marriages of an Argentine man or woman with a European, 2,648 of European with European. In 1865–1870, six years, there were 2,946 marriages of Argentines, 1,391 of mixed stocks, 4,960 of Europeans. In the campaña of Buenos Aires there were in the eleven years 1860–1870, 12,581 inter-Argentine marriages, 3,001 mixed, and 3,023 inter-European.[*] Or, to combine these figures, there were in 1860–1870, in the entire city and province of Buenos Aires, 17,619 native marriages, 5,150 mixed and 10,631 European. Since mixed marriages perpetuate both strains, half may be added to the Argentine and half to the foreign. Then the Argentine marriages stand at 20,194 and the foreign at 13,206—say 60.4 per cent. and 39.5 per cent. respectively.

In this period, antedating the development of cereal production, the Italian element was more numerous than any other foreign element, and in Buenos Aires city, Italian marriages exceeded Argentine. In the other provinces the native element had still an unquestioned supremacy.[†]

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[*] *Rejistro Estadistico de la República Arjentina*, 1869–1871 (Buenos Aires, 1873), p. 292.

[†] *Ibid.*, pp. 294–299, 309.

Yet even then—what has often been observed among large immigrant populations—the newcomers reproduced more rapidly than the native population. In 1860–1864, 10,198 children of Argentine parents were baptized in Buenos Aires city, and 9,786 of foreign parents; in 1865–1870, 11,215 of Argentine and actually 18,399 of foreign parents. Here, indeed, was the irrupting wedge of the new people. But in no other part of the country had it yet pressed so far. Quite as noteworthy is the difference in death rates, for the foreign stock was in the healthy years of life. Among Italians in Buenos Aires city the deaths in 1865–1870 were as one to twenty of the Argentine deaths.*

The census figures of Buenos Aires city, for 1869, may seem to overstate the Argentine strength. In a population of 177,787 they show 41,957 Italians and 89,661 Argentines.† Scrutiny, however, shows that most of the Argentines were very young—the native children evidently not only of the Argentines but of the prolific foreigners (who had begun to come numerously after 1852). Of these Argentines, 35,815 were under ten years of age, 57,074 under twenty. Of the Italians only 3,012 were under ten years and 10,218 under twenty. The 31,739 Italians over twenty were nearly equal to the Argentines over twenty (32,587), and contained fewer people who had passed beyond the reproductive years.

For the period 1870–1880 our information is slight. Although immigration was much below the level it was to attain in the next decade, the foreign biological influence was considerable. In 1882, there were 10,477 births in Buenos Aires city; of 1,836 children the parents were both Argentine, and of 4,049 were Italian; in addition 803 were children of Italian men and Argentine women. In the full decade beginning 1882, births from Argentine unions numbered 22,020; those from Italian unions were three times as many, or 68,703 (annually they were 40–44 per cent. of all births in Buenos Aires), and there were also 10,647 births from unions of Italian men and Argentine women.‡ In this period the number of births from Italian unions increased 136.6 per cent., from unions of Italians men and Argentine women 87 per cent., from Argentine unions 45 per cent. We must remember, of course, that a large increase of Italian parents came by immigration, but also that an important part of the Argentines of this period are the Italian-blooded descendants of the Italian population resident twenty or thirty years previously.

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* *Ibid.*, pp. 313f., 330, 334–336.

† Buenos Aires, *Censo general*, 1887, Vol. I, pp. 447f.

‡ Buenos Aires, *Anuario estadistico*, 1891, pp. 43–45.

A reflection of the fact that the immigrants were in the reproductive years of life appears for the municipal census year of 1887, when the birth rate of the Italians in Buenos Aires was 59 per 1,000, while that of the Argentines was only 28. The high rate was due not only to the greater fecundity of the Italians but also to their high marriage rate. Throughout the period 1882–1891, the number of Italian marriages, already large, increased, till, in 1891, there were 90 per cent. more marriages of Italians than of Argentines.* In the census year 1887, there were in Buenos Aires 11 Italian marriages per 1,000 of Italian population, but less than half this rate, or 5.3 per 1,000, of Argentine population,—a population, as we have seen, in which the young children of foreigners were numerous. The census showed that not only were more Italians married, but their marriage rate—despite the preponderance of men in the immigrants—was higher. It showed that—†

Married	Argentine men	were	10,223,	or 36.7%	of Argentine men	over	20
"	Italian "	"	29,339,	" 38.7%	" Italian "	"	"
"	Argentine women	"	15,897,	" 30.6%	" Argentine women "		15
"	Italian "	"	26,161,	" 65. %	" Italian "	"	"

In this period 1882–1891, marriages of Italian men with Italian women averaged about 31 per cent. of all marriages in Buenos Aires, and marriages of Italian men with Argentine women averaged an additional 10 per cent.‡ Many, and probably most, of these Argentine women must have been the children of Italian parents. Certainly such would tend to be sought by the newcomers. In the great majority of the marriages in Buenos Aires the husband was several years, often ten or twelve, older than the wife—a particularly unlikely situation where the wife was of older Spanish stock.* It is to be remembered also that young wives will have long child-bearing careers.

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* *Ibid.*, pp. 61f.

† *Censo general*, 1887, Vol. II, p. 439.

‡ *Anuario estadistico*, 1891, p. 63.

In 1869 foreigners were somewhat less than half the population of Buenos Aires. In 1887 they stood 112 against 100 Argentines. In the eighteen intercensal years the foreign population had grown, through immigration alone, by 160 per cent.; the Argentine—by the natural increase of the old Argentine and of the new foreign stock—128 per cent.† Only 22 per cent. of the school population (6–14 years) were of foreign birth. The Italian population was 138,166, an increase of 212 per cent. since 1869—a rate approached by no other important strain. In this period therefore the Italian contribution, by way of births, to the Argentine population must have been very heavy. In the reproductive years of life, fifteen to fifty, were 41.6 per cent. of the foreigners, a larger proportion than in 1869; and only 18.3 per cent. of the Argentines, less than in 1869. These conditions may be made clearer in a series of tables.

A‡

(Percentages refer to the whole population, except men under 20 and women under 15.)

15.1%	were	single	Argentines
24.3%	"	"	foreigners
11.4%	"	married	Argentines
41.3%	"	"	foreigners
3.0%	"	widowed	Argentines
4.7%	"	"	foreigners

B§

43.0%	of the	Argentine	men	over	20	were	married	(in 1869, 49.4%)
36.3%	" "	"	women	"	15	"	"	(" " 32.4%)
but 52.6%	" "	foreign	men	"	20	"	"	(" " 46.8%)
and 66.6%	" "	"	women	"	15	"	"	(" " 60.7%)

Mainly, however, the significance of these conditions is to be sought in statistics of births (legitimate):

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* *Censo general*, 1887, Vol. II, p. 420; *cf.* p. 444. In 1882–1887, of 6,376 men marrying at 25–30 years, 2,553 married women of 15–20 years, 2,699 women of 20–25 years.

† *Ibid.*, p. 7.

‡ *Ibid.*, p. 20.

§ *Ibid.*, p. 21.

C[*]

	Father Argentine,	mother	Argentine	1,926	(in 1869, 1,663)
	" "	"	foreign	322	(" " 173)
	" foreign,	"	Argentine	1,932	(" " 1,443)
but	" "	"	foreign	9,761	(" " 3,645)†

D†

Father Argentine,	mother	Argentine	1,909
" "	"	foreign	318
" Italian	"	Italian	7,026
" "	"	Argentine	1,011
" Spanish	"	Spanish	1,080
" "	"	Argentine	412

The total births, except illegitimate (1,974) and of colored parents (171) were 13,965. Note how rarely, judging by births, the Argentine man marries a foreign woman, and how frequent is the contrary case.

Of the births of 1887, 47.1 per cent. were from Italian mothers, and 24.9 per cent. Argentine. Children who were not more than the eighth birth in a family, had in 3,710 cases Argentine mothers, but in 7,112 cases Italian mothers—nearly 90 per cent. more.‡ These Argentine mothers had already borne 11,404 children but the Italian mothers had borne 23,330—nearly 108 per cent. more. Many of the Italian mothers were recent immigrants and young women, with child-bearing careers largely ahead. The greater fecundity of the foreign stock is still further shown in figures compiled for the six years 1882–1887. For each ten marriages of Argentines there had been, by the census year 1887, 32 children; for each ten foreign, 51 children.§ Still more detailed figures show that the Italians more often have children than do Argentines and have more children.**

To give an indication of the strength of the various important nationalities in the population of Buenos Aires in 1887, I have indicated below the number of existing marriages of each sort and their issue. In reading the table it must be remembered that Argentine families, as a class, have been longest in existence.††

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[*] *Ibid.*, p. 411.

† *Ibid.*, p. 410.

‡ Compiled on basis of figures in *ibid.*, pp. 412ff.

§ *Ibid.*, p. 427.

** *Ibid.*, pp. 428f.

†† *Ibid.*, pp. 439f; I have calculated the figures of the last column.

Number of Marriages	Husband	Wife	Children per 100 Marriages	Total Number of Children
8,875	Argentine	Argentine	234	20,767
374	"	Italian	161	602
3,179	Italian	Argentine	228	7,248
25,006	"	Italian	228	57,013
331	"	Spanish	200	662
1,602	Spanish	Argentine	233	3,732
4,364	"	Spanish	208	9,077
2,970	French	French	177	5,256

In the same year, 1887, the provincial census of Santa Fé was taken. Its statistics are much less detailed than those we have been considering. Of married Argentines 14,717 were found, and an almost equal number, 14,736 of married foreigners, mainly Italians. The average number of children had been 4.9 for the Argentine families and 4.6 for the foreign.* Presumably, in this country of early marriages, the Argentines included no inconsiderable number of the children of Italians. For there were actually more foreigners (3,879) who had been married more than twenty years than Argentines (3,690), and they had been the parents of many children: the Argentines of 27,032, the foreigners of 26,269.† Of the older Italians many had been married in Italy. In this province of Santa Fé, the second in population in Argentina, the Italian factor had great strength.

The year 1895 brought the second national census. In the twenty-six years since the previous census, the native population had not quite doubled, while the foreign had quintupled and come to be one third the size of the Argentine. Italians, who meantime had been three fifths of all immigrants—many being seasonal—were 49 per cent. of the foreign population. After them came the Spanish (19.8 per cent.) and the French (9.4 per cent.).‡ How largely the Argentine population represented recent births, and therefore largely births from foreign unions is manifest in the age statistics. If Argentines under twenty years of age (1,770,831) are deducted from the total number of Argentines (2,950,384), only 1,179,553 are left who were born before 1875. Those born before 1865 were only 710,900. Exactly one half the population of the country were under twenty years of age. Among the Argentines, 61.3 per cent. of the males, 58.7 per cent. of the females were under twenty years; among the foreigners only 17.8 per cent. and 25.7 per cent., respectively. Of the foreigners, 796,979 had been born before 1875; 569,639 before 1865.* These figures suggest that many of the Argentines were the children of foreign parents.

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* Santa Fé, *Primer censo*, Vol. I, p. xcvii.

† *Ibid.*, p. xcviii.

‡ República Argentina, *Segundo censo*, Vol. II, p. xliv.

More definitely is the increasing importance of the foreign element demonstrated in the census statistics concerning the marital status of persons who had reached their fifteenth year. For comparison I give also the figures for 1869.†

	1869.			1895.		
	Men	Women	Total	Men	Women	Total
Argentine:						
Single	557	525	540	583	508	545
Married	386	349	366	325	351	339
Widowed	57	126	94	39	104	73
No data	....	....	....	53	37	43
	1,000	1,000	1,000	1,000	1,000	1,000
Foreign:						
Single	576	294	500	442	204	358
Married	381	591	438	494	677	559
Widowed	43	115	62	42	104	64
No data	....	....	....	22	15	19
	1,000	1,000	1,000	1,000	1,000	1,000

It is difficult to explain these striking differences between the native and foreign elements only by supposing that the single men, of whom there are 141 more in 1,000 Argentines than in 1,000 foreign, marry later in life than formerly. (So far as the Argentines marry later than the foreigners, their generation is longer and their contribution to the race, in any given period of time, less.) The change since a quarter century earlier has been mainly among the foreigners: more of them, women as well as men, are married. Among women the absolute figures are truly striking.

Of 315,350 adult foreign women, 213,695, or 68% are married
" 818,080 " Argentine " 287,516, " 35% " "

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* Compiled from *ibid.*, Vol. I, p. xcix.

† *Ibid.*, p. cviii.

Since, furthermore, 46,926 married Argentine women have foreign husbands, only 240,590 are married to natives. And of these a large part undoubtedly are the children of immigrants, rather than of the anterior population.

An explanation of the declining importance of the old stock made by the director of the census is *à propos*. The foreigners, he declares, are more industrious and thrifty than the natives, and so more quickly and more surely reach a stage where they can afford to marry. While the Argentine woman is usually only a consumer, the foreign wife nearly always aids her husband in production. The foreigner relies upon this economic aid. The native does not expect it, therefore avoids marriage, and—*razon poderosa*—finds its substitute in the less expensive luxury of illicit relations.*

The figures of 1895, showing the child-bearing part of the foreign-born population to be not greatly less than that of the native-born, concern the whole country. Yet the figures for Buenos Aires, as utilized in the year-book of that city, have additional interest.† There, of the Argentine women who had reached their fifteenth year, 25,792, or 37.7 per cent., were married; of the foreign women, 75,859, or 69.5 per cent. A later age at marriage, in the case of the Argentine stock, will diminish but by no means undo the difference. In each 1,000 Argentine women, single or widowed, aged 15 to 50, 51.2 married during the year; in 1,000 Spanish, of the like class, 106.4; in 1,000 Italian, 134.8. And again, for 1,000 married Argentine women of these ages, the year's births were 92; for 1,000 Spanish, 155; for 1,000 Italian, 194. Señ. Martinez, describing the "social capillarity" of the Argentine population, parodies Malthus: desires grow in geometrical progression, but the possibilities of satisfying them only in arithmetical progression.

Since 1895 a decline has taken place in the relative strength of the Italian-born factor in Buenos Aires. Marriages to which both parties were Argentine were, in the early 1880's, about 20 per cent. of all. After lapsing to 13 per cent. in 1890, they rose again, by 1900, to 21 or 22 per cent.,—a common proportion since. Italian marriages, from having been upwards of 30 per cent. in the early 1880's, declined to 27 per cent. in 1897 and to 17 or 18 per cent. in 1907 and 1908. Spanish marriages rose from 6 per cent. in 1882 to 10 per cent. in 1889, then to 12 per cent. in 1899 and 20 per cent. in 1908. Thus Spanish marriages were one half the Italian marriages of 1899 and actually surpassed their declining share in 1908. It must, however, be added that while the unions of Spanish men and Argentine women have fluctuated little about 4.5 per cent. since 1882, Italian marriages with Argentine women have of late years been nearer 11 than 9 per cent. These figures seem to indicate that immigrant intermarriage with old Argentine stock is, and probably has been rare. Since Spaniards speak the same language as the old Argentines, their intermarriages would naturally be at a greater rate than those of Italians and Argentines. The conclusion seems appropriate that in Italo-Argentine marriages the bride is the native daughter of an Italian.* If the conclusion be accepted, then the Italian marriages of 1908 did still exceed the Spanish.

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* *Ibid.*, p. cxiii.

† Buenos Aires, *Annuaire Statistique*, 1895, pp. li–lix.

That the Argentines have come to be largely the descendants of immigrant stock of the last few decades is a thesis further to be strengthened in the statistics offered by the Buenos Aires municipal census of 1904. It appears that this great city has only recently begun to rely for its increase of population on births. Before the great immigrations, in 1869, natives of the capital were 44.4 per cent. of the population. In 1887, they were only 17.3 per cent.; in 1895, 26.6 per cent.; in 1904, 33.7 per cent. Indeed, the prodigious nine-years growth from 663,854 to 950,891 inhabitants was mainly from births; the population from this source increased 64 per cent. while that that had come from abroad increased only 24 per cent. In the total population of Buenos Aires, natives, born in whatever part of Argentina, now numbered 55 per cent., Spaniards 11, and Italians 24.†

An examination of the age statistics of this census should set beyond a doubt the correctness of the view that the

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*In 1908 two thirds as many Italians married Argentines as married Italian women. All the figures in this paragraph are based on the year-books issued since 1895.

†Buenos Aires, *Recensement général*, 1904, pp. lxiiif, 23–25.

Argentines derive mainly from the immigrants who came since 1860 and who chiefly were Italians. Of the 534,041 persons composing the Argentine group, 364,964, or 69.5 per cent., had not yet reached the age of twenty—*i. e.*, had been born since 1884. In addition, 98,602 had been born between 1869 and 1884.* So 463,566, or actually 88.6 per cent. of all the Argentines, had been born since 1869. Had the native population censused in 1869—78,976 born in the capital, 6,653 in the provinces (surely even in these figures were some children of foreigners)—doubled by natural increase each twenty-five years, it could have accounted for only 256,887, or 49 per cent. of the Argentine population of 1904. But an old population in a city almost never doubles in twenty-five years; on the other hand, there had also been provincial immigrants.

Consider the age statistics further, however. Foreigners under twenty, who therefore had contributed few children to the Argentine population were only 62,008, or 14.4 per cent. of the foreign population. Above this age the foreigners, with their high marriage rates and birth rates, must have contributed many children. Foreigners aged 20–49 numbered 283,455, or more than twice as many as the natives of the same years (140,081); these groups were still reproductive. Of persons older than 50 years—born before 1854—there were 17,370 Argentines and 77,047 foreigners. For the significance of these figures it must be recalled that very few immigrants arrive after the expiration of the reproductive term, and most arrive before that term is even half past.†

Not only has the older Argentine stock in Buenos Aires been submerged by the immigrant stock, but in the latter the Italians have easily led. There were in 1904 only 28,664 Italians under 20, but there were 152,073 Italians aged 20–49, or actually 12,000 more than Argentines of these ages; and there were 47,158 over 49 years, or about 30,000 more than Argentines of this group. The recent increase of Spanish immigrants is yet far from equalizing the two populations in Buenos Aires: in 1904 they were only half as numerous as the Italians in both the age groups 0–19 and 40–49, and above 49 they were less than one third as numerous. Of married persons with spouses living there were 139,835 Italians, 75,577 Argentines and 52,701 Spanish.*

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* Age groups 20–24, 25–29, and one half—a conservative portion—of 30–39.

† The percentages of this and the preceding paragraph were calculated on the basis of figures given in *ibid.*, pp. 30–34.

In a city where more than four persons in five (81.7 per cent.) aged 50 years or over are of foreign birth, it is not likely that less than four in five persons under 20 years (85.4 per cent.) though described as native are of other than immigrant origin. From the census figures it can, in fact, easily be calculated that the Italian mothers had borne somewhat more than 258,679 children, Spanish mothers more than 82,325 and Argentine mothers 145,361. One more detail is worth adding: among all women married as long as 20–25 years, four fifths had married before the age of 25, and of these one half before 20.†

The main contributions of the municipal census of 1909 may be set forth more briefly. The leading groups were 670,513 Argentines, 277,041 Italians, 174,291 Spanish. Of the Argentines, men and women, half were in the reproductive years 15–50; of the Italians three quarters. Italians aged 40–70 numbered 172,182, Argentines only 133,644—once more an indication of early heavy Italian contributions to the race stock.‡

Of striking value is a table dealing with fecundity. There were more Argentine married women who had had no child or only one child than there were Italian. But more Italian women than Argentine had been mothers of two children and of *each number* of children through "sixteen or more." The 51,984 Argentine mothers (neglecting 3,202 whose number of children was not determined) had given birth to 203,738 children, while the Italian mothers (neglecting 4,768 whose number of children was not determined) had borne 338,555 children.§

What of the rest of Argentina? Buenos Aires city, though embracing a fifth of the population of the republic, cannot claim to be typical. Yet the other populous regions are the cereal regions, where, after all, the Italians have chiefly gone.

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* *Ibid.*, pp. 35–39, 64.

† *Ibid.*, pp. 90–101.

‡ Buenos Aires, *General census*, 1909, Vol. I, pp. 37–40. I have calculated the figures.

§ Calculated on basis of figures in *ibid.*, Vol. I, pp. 111, 112. I have had to neglect the indefinite "more" children beyond 16 births.

Of Buenos Aires province we can only say that the Italians are numerous. Of Santa Fé, the second province in population, we have spoken. There are many indications that the Italians are numerous in the interior cities. Rosario grew even faster, before 1895 at least, than Buenos Aires. In the rural sections the Italians were often the largest group. At the beginning of the present century, in the Córdoba colonies, Italian fathers of families were three quarters of all.[*] In the rural sections, where every arm contributes to the family income, we may be sure that immigrants have been prolific. Indeed, whenever in the Italian consular reports, there is reference to size of families, it is invariably to say that they are large—characteristically, that while one child is being born, another is marrying

Especial interest attaches to the census taken in 1909 by Mendoza, because the circumstances in this province differ broadly from those of either Buenos Aires city or the cereal provinces. There are small towns, and vineyards, and wine-making establishments. The Italians are one eleventh of the population. But their tendency to have large families has here, as elsewhere, asserted itself. Of the 3,426 Italian wives, 658 had been married for 25–50 years. Of these more than two fifths (284) had borne not less than nine children each, and had borne an average of about twelve children. The 284 mothers had had some 3,300 children.[†]

In view finally of the early coming of the Italians, of their continued coming, and of their rates of reproduction, I believe the figure of 28 per cent., tentatively reached above, for the proportion which they and their children make of the total population of Argentina, to be conservative. Even without including their children's children, it should be raised, and when these are included will surely reach nearer to one third than to one fourth of the population. The rough guess hazarded by Bryce[‡] certainly does not seriously overstate the truth: "The Argentine of the future will probably be one third Italian in blood.

[*] M. E. Río and L. Achával, *Geografía de la provincia de Córdoba* (Buenos Aires, 1904), Vol. II, p. 179.

[†] Mendoza, *Censo general*, 1909, p. 55. I have calculated the number of children, which remains indefinite because 35 mothers had 16 "or more" children.

[‡] *South America—Observations and Impressions* (New York, 1912), p. 438.

HOW TO FIGURE LABOR TURNOVER.

By Frederick S. Crum.

The term *labor turnover* has been variously defined and as its calculation is dependent upon its definition, attention should first be given to just what the term means. So far as I am able to find out from reading an already somewhat extensive literature on the subject, labor turnover was first used and is still most widely used to express the phenomenon of hirings necessary to replace separations in any given industry, establishment or department of an establishment. Before the subject was analyzed too closely, perhaps, by writers of the academic type, labor turnover or the flow of labor in any given industry or establishment, was measured in terms of the average or normal payroll, and it was expressed in the form of percentage of such payroll during the period under observation—usually a week, a month or a year. If the average payroll of a given establishment were 1,000 in a business which required that such payroll be kept at that figure and during a year 500 additions to the payroll were necessary to replace separations therefrom, the yearly labor turnover would be expressed as 50 per cent., or $\frac{500}{1000}$. On an increasing payroll in a growing business the separations from the payroll would still represent the numerator and the average payroll the denominator. On a decreasing payroll in an establishment gradually going out of business, perhaps, or declining from any cause whatsoever, the numerator would be the number hired and the denominator the average payroll, as before. In other words, average payroll by this most generally employed method is always the denominator and the number of employees *replaced* during the period under observation is the numerator in the calculation of *labor turnover*. As this is the older, so, I believe, it is also the best method of measuring labor turnover. Whatever method of calculation is ultimately agreed upon, the statistical problem of *labor turnover* can still be truly stated as Richard B. Gregg has stated it, namely, as the "measurement of the movement of industrial workers in and out of their employment, and the analysis of its causes and results."

At the National Conference of Employment Managers held in Rochester, N. Y., May 9–11, 1918, a committee was appointed to draft a report which would define labor turnover and state how it should be calculated. The report made by this committee reads as follows:

"Labor turnover for any period consists of the number of separations from service during that period. Separations include all quits, discharges and lay-offs for any reason whatsoever.

"The percentage of labor turnover for any period considered is the ratio of the total number of separations during the period to the average number of employees on the force report during that period. The force report gives the number of men actually working each day as shown by attendance records.

"To compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day throughout the period."

In brief, this committee advocated the use of attendance force rather than payroll in the calculation of turnover percentages. This seems to have been the main principle advocated in this report, but it is somewhat ambiguous and misleading in some of the statements. For illustration, labor turnover for any period does not necessarily "consist of the number of separations from service during that period." In the current and recent history of shipyard plant construction we find many illustrations of the falsity of this statement. When a shipyard nears completion many of the men engaged for its construction must be laid off from day to day, and these separations do not all represent labor turnover, according to the best and most usual definitions of that term. On a decreasing payroll only the number hired can truly represent replacements or turnover.

The statement that "to compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day throughout the period" is to me ambiguous. Probably all that is meant is that the average daily attendance is recommended as the divisor. If so, it does not mean that only those are to be included in the denominator of the fraction who have worked or been in attendance "each day throughout the period." It is conceivable that the turnover in a given year would be represented by infinity in an establishment where no employee could show a record of 100 per cent. attendance. The point in this committee report, however, which challenges discussion is the recommendation that the working force, as shown by attendance records, be made the basis upon which labor turnover is calculated rather than payroll force.

Anyone who has had wide experience in studying comparative labor turnover figures in such an extensive industry as shipbuilding will at once question the validity of this new method apparently advocated by at least some of the employment managers at the National Conference in Rochester, last May (1918). One of the principal objections to it is that attendance is a more fluctuating factor than payroll. On an extremely hot day, 1,000 or more men out of a force of 5,000 might lay off for the one reason "too hot to work." This is not an isolated instance; there are plenty such illustrations in the daily attendance reports of the 160 or more shipyards which it was my privilege to review for a period of eleven months this past year. Heat, cold, blizzard, rain and snow are meteorological conditions which cause wide fluctuations in daily attendance in shipyard and other outdoor employments. Again, an epidemic period such as that we have been experiencing in the shipyards since September, causes most violent fluctuations, daily, weekly and monthly, in the attendance records—much wider variations, quite naturally, than are reflected in the payrolls. In the first week of October, 1918, it was reported that approximately 6,000 out of 19,000 employees of three large shipbuilding plants at Gloucester, N. J., were ill with influenza. Obviously, the resulting temporary low attendance had little or no real relation to labor turnover. Why then, should this attendance factor be used in calculating turnover percentage?

Another objection to the attendance records as a basis for the calculation of labor turnover percentages is that very frequently the separations or quits when recorded are of employees who may not have been in attendance for a day, two days or longer. Theoretically, the payroll is, therefore, a better denominator for the labor-turnover fraction as it always contains the whole labor force, while the attendance force at any given time may range from 100 per cent. of the payroll down to 50 per cent. or even less in severe weather, during an epidemic, obstructed traffic, etc. These latter phenomena, while affecting attendance seriously, may not and often do not affect the payroll or the separations so far as these enter into the labor-force records.

One of the best statements that I have seen advocating payroll in preference to attendance as representing average force for labor turnover calculations is that by Mr. E. Goldberger, efficiency engineer, Packard Motor Car Company, published in the November, 1918, issue of *Industrial Management*. The statement follows:

"The total number of men that have been hired and been paid off, *i. e.*, actually replaced, represents a complete turnover, and if there be an excess of men hired over paid off, they actually are to be accounted to increase in force, while if there be an excess of men paid off, they represent a decrease in force.

"There are more reasons in favor of counting the men on our books rather than those really attending, as some men leave without notice, passing through a transitory stage of not attending and still being on the books, so that, when they leave and are counted in the turnover, they do not represent the turnover of the force working, but of that on our books.

"It is much easier to count the men on the books than those attending, as the first information can be made available quickly in the employment office, while the last one has to be made available by many clerks in different departments or by the time office.

"It is very likely that high wages, where they are unwarranted, will force us to face the problem of absentees, and to study a standard coefficient of attendance. This is, in my opinion, a good enough reason to keep the same denominator for all three coefficients—labor turnover, labor fluctuation and labor attendance."

The following quotation* also is in conformity with my own point of view, as regards the method of calculating the labor turnover:

> What most persons mean by labor turnover is labor replacement. The term labor turnover arose in connection with discussions of the cost of hiring and firing workers. It was recognized that men drifted in and drifted out of industries. Competent men often did not stay, and incompetent men had to be fired after expensive trial. Effective labor service finds the right man for the right job and then gets him to stick. If he does not stick then someone else has to be hired to take his place, or if a mistake in judgment is made and an unfit person employed, then that person has to be fired and another worker found for his job. This is labor turnover but a better and more accurate phrase is to think of it as necessary *labor replacement.*
>
> The National Employment Managers' conference by deciding that the number of employees actually working each day rather than the number appearing upon the payroll should be the proper base for computing labor turnover introduced another factor into personnel fluctuation. This factor, which may be termed *labor variation,* is something different from either plant change or labor replacement.
>
> The number of the working force actually working on any one day is dependent upon sickness and accident, upon explainable absences, and upon habitual loafing usually after pay day. Increasingly, employment offices are keeping records of these daily absences, seeking for the causes of these constant leaks and endeavoring to stop them. But such absences do not mean usually that a man is fired or even that some one is hired to take his place. This labor variation is not labor turnover as the term is ordinarily used. Yet if the daily working force rather than the payroll sheets are used as the base for figuring labor turnover then this element of temporary absences affects to some degree the percentages.
>
> A report then of personnel fluctuation for any period of time should show in percentages the plant change, the labor replacement and the labor variation. These are three distinct elements in the personnel fluctuation. They are due to different causes, require different remedies and should never be confused.
>
> One other subdivision may be desirable. Persons whose places must be refilled leave for avoidable and unavoidable reasons. Among the unavoidable reasons are marriage, death, ill health, retirement, family leaving city, and military service. It is worth while to divide the leavings under labor replacement into avoidable and unavoidable, making separate percentages.

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* From "Standardizing Labor Turnover" by Harry W. Kimball, *Industrial Management,* December, 1918.

The decrease of the avoidable leavings from week to week, and from year to year, is the true measure of the efficiency of the labor service.

While a record should be kept of all transfers from one department to another within the plant, these transfers should not enter into the calculation of any personnel fluctuation as they do not increase or decrease the working force.

The simplest way of calculating these three elements of personnel fluctuations is by the week, and the simplest base to use is the number on the payroll.

Daily attendance records are extremely important and hours-of-work records, also very important for several purposes, should be available to the manager of a plant or establishment, but I seriously doubt their utility in the calculation of labor turnover. Payroll measured against daily attendance gives a reasonable notion of the percentage and total amount of absenteeism. Such ratios could be computed weekly, monthly, quarterly and yearly. In other words, daily attendance should preferably be considered as a coefficient of payroll. Among shipbuilders, for the country as a whole, approximately 85 per cent. of the average payroll was in daily attendance. There were wide variations, however, from this figure when individual yards, different sections of the country and the different seasons of the year were considered.

For a proper measurement of daily attendance good payroll records must be freshly available and, if available, there would appear to be no good reason why labor turnover should not be measured against payroll rather than against attendance—a more widely fluctuating, and at least as regards *labor flow* a more artificial factor than payroll. Perhaps one objection to the use of payroll records is that they sometimes are not cleared frequently enough. This is not a valid objection in labor turnover calculations, for the net gain or loss in the payroll is readily obtained when the number hired and the number of separations are known for a given period. An effort should be made to bring about standard and uniform practice in the keeping of all labor or work-time records, and payroll records unquestionably should be more uniform and accurate than at present. Probably the most generally feasible plan would be to have the payrolls cleared at least twice a month, preferably, perhaps, on the first and fifteenth of each month. Such payroll figures would, I believe, give an excellent basis from which to calculate labor turnover or replacement percentages, labor fluctuations, and daily attendance. If the payroll were cleared weekly the accuracy of the calculations would, of course, be somewhat greater.

Unless some sound standard as to the factors which shall be used in calculating labor turnover is adopted and applied generally at an early date, there will be created a still greater statistical chaos than already exists. At present not only is there no universally or even generally recognized method of calculating labor turnover, but there is also an "utter lack of any standards in estimating cause, extent and cost of labor turnover."*

An efficient employment manager is probably the first and most important step in any effort to bring about stability in the labor force of an industrial plant. The employment manager can perhaps best demonstrate his efficiency by pointing to the reduction of the labor turnover under scientific as compared with the previous and presumably unscientific "hire and fire" method of foremen. To the employment manager, therefore, it is important that his methods of calculating labor turnover shall be uniform and on a basis that can be defended by sound common sense and logic.

Labor turnover should be measured for the principal departments of any given plant as well as for the plant as a whole. Transfers from one department to another would enter into the labor turnover of the departments affected, but such transfers would not count in the labor turnover of the whole plant. In the United States there is a large amount of interstate migration but these migrants are not added to the statistics of immigrants and emigrants for the United States. The analogy illustrates how transfers should be handled. The labor turnover of the departments of any given plant if summed would show too large a labor turnover for the plant as a whole, provided there had been interdepartmental transfers.

Turnover figures are valuable only as they are used and understood by the employment manager and by the plant management as an index to the labor conditions. When the labor turnover figures are reduced to simple percentages which always have definite significance, the management will get light upon many problems, the solution of which is necessary to effect a reduction in turnover. As the necessary remedies are applied the labor turnover percentage furnishes an index of the result of the remedies. A few of the many partial solutions of the big problem of turnover are profit-sharing, bonus payments, group insurance, other insurance provision for employees such as disability allowances, pensions, etc., good restaurant facilities, quick promotions for the most capable, careful fitting of the employee to the job, etc.

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*"An Initial Survey of the Problem of Labor Turnover," Confidential Reports Series, Report No. 1, The National Association of Corporation Schools.

Mere expression of labor turnover in percentages will never solve the problem, but a simple mathematical statement of its size is likely to persuade the manager that it is important to seek for the causes why men leave in such large numbers. Next, he is apt to study the cost of turnover and, finally, he will be in a position to justify to himself or to the owner of the business that it is better to spend money for preventive measures than for the wasteful and reckless hiring and firing methods so usual in American business. The mathematical formula of labor turnover will thus be transformed into a better understanding of the human element, with the result that the average length of service of the employees will be considerably extended and the labor turnover correspondingly reduced, to the great and mutual advantage of employer and employees.

ILLUSTRATIONS OF LABOR TURNOVER CALCULATIONS.

For an increasing payroll the following example will illustrate the method when payrolls and changes in same are available in weekly reports. Some months will embrace five weeks and others four. Any given week should be included in that month which embraces four or more of its days. When five weeks are included in a given month the turnover percentage for the month must be mutiplied by 10.4 to reduce it to a yearly basis, and when only four weeks are included the factor for multiplication is 13.

INCREASING PAYROLL.

Week Ending	Payroll	No. Hired	No. Lost	No. Replaced	Labor Turnover Percentage	
					Weekly	Yearly
Oct. 5, 1918...	2,593	37	15	15	.58	30.1
Oct. 12, 1918...	2,615	42	17	17	.65	33.8
Oct. 19, 1918...	2,640	26	19	19	.72	37.4
Oct. 26, 1918...	2,647	17	20	17	.64	33.4
Nov. 2, 1918...	2,644	22	18	18	.68	35.4
Total........	13,139	142	89	89	3.39	35.2
Average Payroll	2,628					

In this example the fundamental data are assumed to be available, week by week, and the establishment is assumed to be a growing one with weekly additions to the force generally larger than the subtractions from all causes whatsoever. In this example the weekly percentages of turnover varied only slightly, or from *.58* to *.72*. Multiplying the weekly turnover percentages by 52 reduces them to a yearly basis. For the month ending November 2 the turnover percentage was 3.39. As the period was really five weeks, or 10.4 part of a year, the turnover percentage reduced to a yearly basis is 3.39 multiplied by 10.4, or 35.2.

In the next example the week ending October 26 is purposely shown as indicating a greater loss than gain in the payroll. The replacements for that week represent the number hired rather than the number lost, or 17 rather than 20. For the five weeks as a whole, however, the number hired are in excess of the separations so in the totals the 20 is included as replacements. When large numbers of industrial establishments are being followed week by week, as is done in the Emergency Fleet Corporation, the weekly turnover percentage is a valuable index of the general trend of this phase of the labor problem. It should also serve a useful purpose in any industrial establishment. The payroll, however, should be cleared weekly, if feasible, and at worst, not less often than every two weeks if the labor turnover is to be calculated with a close approximation to exactness.

DECREASING PAYROLL.

Week Ending	Payroll	No. Hired	No. Lost	No. of Replacements	Turnover Weekly	Percentage Yearly
Oct. 5, 1918...	6,754	70	95	70	1.04	53.9
Oct. 12, 1918...	6,729	47	83	47	.70	36.3
Oct. 19, 1918...	6,693	27	78	27	.40	21.0
Oct. 26, 1918...	6,642	50	45	45	.68	35.2
Nov. 2, 1918...	6,647	39	60	39	.59	30.5
Total........	33,465	233	361	233	3.48	36.2
Average Payroll	6,693					

In this example the payroll is fairly continuously diminishing. In such instances the number hired rather than the number of separations represent the turnover for only such losses are replaced as are represented by number hired during the period under observation. During the five-weeks period, in the example, obviously the turnover percentage is represented by 233, the number hired, divided by 6,693 the average payroll, or 3.48. The factor 3.48 multiplied by $\frac{52}{5}$, or 10.4, gives 36.2 as the labor turnover percentage, yearly basis.

During the week ending October 26, 50 men were hired as against 45 lost from the payroll. In the calculation of the weekly turnover percentage for that week, the number of replacements must be considered as 45, therefore, and not 50, although the 50 should be used when calculating the turnover for the five-weeks period.

If labor turnover percentages are to be calculated only on a monthly basis, the payroll should preferably be given for the first and fifteenth of the month so as to get as true an average or mean payroll as possible. If this is not feasible the next best thing is the payroll at the beginning and end of each month from which approximate means can be derived for each month by taking the sum of the two numbers and dividing by two.

The simplest formula for labor turnover and one which will serve every practical purpose is as follows:

$$T = \frac{R}{\dfrac{P_1 + P_2 + P_3 + - P_n}{N}}.$$

In this formula:

T = Turnover.
R = Replacements, or number hired to replace losses.
P = Payroll.
N = Number of Payrolls used in striking an average for the period under observation.

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ANALYSIS OF THE STANDARD OF LIVING IN THE DISTRICT OF COLUMBIA IN 1916.*

BY WILLIAM F. OGBURN.

At the close of the year 1916, the U. S. Bureau of Labor Statistics collected over two thousand budgets of families living in the District of Columbia showing details of expenditures for the calendar year 1916. An analysis of these budgets was published in the "Monthly Review of the U. S. Bureau of Labor Statistics" for October and November, 1917. It is the purpose of this paper to show a somewhat more detailed analysis of this study in order to bring out more nearly complete information concerning the lives and habits of these families, than appears in a brief analysis. In doing this, it is also the purpose of this paper, to use a method which not only presents rather full information with considerable brevity, but generalizes from the sample in such a form as to permit a large number of comparisons, and to make a number of detailed estimates and predictions.

The budgets were collected in such a manner as to be representative of the community as a whole for families of low and moderate incomes. They were from the black and white races and included a variety of nationalities and occupations. There was no limitation as to size and constituency of the family. Families with incomes over $2,000 a year for others than wage earners were excluded; as were also families in which the husband earned less than 75 per cent. of the total income. The budgets were collected in a house-to-house canvas by agents. Of these 2,110 budgets 200 were selected for the purpose of this analysis. The selection was of white families comprising at least a man and wife living in rented houses without lodgers, boarders or adults, other than children. Also only those schedules were chosen which contained full detailed data on expenditures for sundries. This selection yielded only 200 cases. About 90 different occupations were represented, distributed among the unskilled, the semi-skilled, and the skilled trades, as well as among other occupations as clerks and salesmen.

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* Paper read at the Eightieth Annual Meeting of the American Statistical Association.

What we really want to know about such budgetary studies is how the expenditure for various items varies with the size of the income and with the size of the family. The problem of analysis consists, then, of classifying the various items of expenditure by income and by size of the family. The items of expenditure studied in this analysis are food, rent, fuel and light, clothing, sundries, husband's clothing, wife's clothing, children's clothing, insurance, furniture and furnishings, contribution for religious purposes, education, amusement, liquor and tobacco and sickness. Various relationships may also be shown between these items of expenditure. A list of the variables, their definition and designation, used in these relationships follows.

DEFINITION OF VARIABLES.

X_1 = Annual income of family for a year in dollars, and includes earnings from garden, earnings of wife, if any, and all other income, including gifts.

X_2 = Deficit or surplus, and is the difference between income and expenditure. Expenditure includes the total for the same year for which income is computed, and includes unpaid bills, such as doctors' bills. A deficit is listed with a minus sign and a surplus with a plus sign.

X_3 = Size of family, as measured in units of an adult male, based on food consumption. The U. S. Bureau of Labor Statistics scale is used, which rates a woman as 0.9 of an adult male, child (11 to 14) as 0.9, child (7 to 10) as 0.75, child (4 to 6) as 0.4, and child (to 3) as 0.15. A further discussion of this measure of size of family is found in a later paragraph.

X_4 = Percentage of total expenditure spent for *food* in a year for a whole family, and includes confectioneries, lunches taken out, and ice.

X_5 = Percentage of total expenditure spent for *rent* in a year for the whole family. If two or more houses were lived in, the rents for each fraction of a year were totaled. Owned houses and houses in which lived lodgers or boarders with the family were not included. Rent does not include fuel and light (except in four cases).

X_6 = Percentage of total expenditure spent for *fuel and light* in a year for the whole family.

X_7 = Percentage of total expenditure spent for *clothing* for the whole family. No family includes others than man, wife and children, and at least every family had a man and wife.

X_8 = Percentage of total expenditure spent for *sundries.* Sundries means all expenditures other than expenditures for food, rent, fuel and light, and clothing. It includes insurance, dues to organizations, payments for religion, amusement, education, sickness, furniture and furnishings, and expenses for various incidentals and exigencies.

X_9 = Percentage of total expenditure spent on *husband's clothing.*

X_{10} = Percentage of total expenditure spent on *wife's clothing.*

X_{11} = Percentage of total expenditure spent on *children's clothing.*

X_{12} = Percentage of total expenditure spent for *insurance* of all kinds, including fraternal, industrial and "old line" insurance.

X_{13} = Percentage of total expenditure that went to institutions or organizations of *religion.*

X_{14} = Percentage of total expenditure spent for *furniture and furnishings.* In cases of furniture bought on the installment plan, the installments which are paid and are due during the year are included.

X_{15} = Percentage of total expenditure spent on *education.* Educational expenditures include in this study essentially, newspapers, books, magazines and school expenses of children of high school age. Education is a somewhat inaccurate descriptive term for the items of expenditure included here.

X_{16} = Percentage of total expenditure spent for *amusement,* including movies, theatres, dances, pool, etc. Amusement generally is a much broader term than is here suggested by these particular items of expenditure.

X_{17} = Percentage of total expenditure for *liquor and tobacco.* At this time it was legal to sell liquor in Washington.

X_{18} = Percentage of total expenditure spent for *sickness.* This includes unpaid doctors' bills incurred during the year, also medicines, drugs, nurse and hospital expenses. The meaning of the correlations involving amount spent for sickness is not clear for the amount spent for sickness does not necessarily indicate the number of days of sickness.

X_{19} = Total clothing expenditure in multiples of the amount spent for the husband's clothing, and is found by dividing the expenditure for man's clothing into the total expenditure of clothing. These ratios are studied for the purpose of supplementing the information gathered from the indexes of equivalent adult males in food consumption as to validity of these figures as indexes of the size of the family.

X_{20} = *Cost per adult male per day* in food consumption, and is determined by dividing the total yearly family food bill by 365 and then by dividing by the number of equivalent adult males in food consumption in the family.

Table I shows how the data may be classified. In this table, the percentage of expenditure for food is classified according to families of various incomes. This table shows therefore the relationship between income and percentage of expenditure for food. Similarly the relationship between income and the various other items of expenditure have been analyzed, the tables not being presented here. Also the percentages of expenditure for various items of the family budget have been classified, according to size of family in similar tables, and other tables have been constructed showing various relationships.

TABLE I.

RELATIONSHIP BETWEEN SIZE OF ANNUAL INCOME AND PERCENTAGE OF TOTAL ANNUAL EXPENDITURE SPENT FOR FOOD.

	500–	600–	700–	800–	900–	1000–	1100–	1200–	1300–	1400–	1500–	1600–	1700–	1800–	1900–	2000–	2100–	2200–	
20–	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
22–	..	..	1	..	..	..	..	..	..	1	1	1	..	..	..	..	..	..	4
24–	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1	1	..	..	4
26–	..	..	..	1	..	..	..	1	..	..	2	..	..	..	1	..	..	..	5
28–	..	..	..	..	1	1	1	1	..	2	1	..	..	..	..	..	..	1	8
30–	..	1	..	..	..	1	..	..	..	2	2	1	..	..	..	..	..	..	7
32–	..	..	..	1	1	..	2	2	4	1	2	2	1	1	..	..	..	..	17
34–	..	..	2	2	..	1	..	1	..	3	3	1	..	..	..	..	..	..	13
36–	..	1	..	2	1	3	..	4	..	2	..	..	..	..	..	..	..	..	13
38–	..	1	1	2	4	3	2	2	1	3	3	..	..	..	..	..	..	..	22
40–	..	1	..	5	1	2	5	4	3	3	1	..	1	..	..	..	..	..	26
42–	1	1	1	3	3	..	1	3	1	1	1	..	..	..	..	..	..	..	16
44–	..	1	3	1	2	1	..	1	..	2	1	2	..	..	..	..	..	..	14
46–	2	1	5	3	1	..	1	..	3	1	..	..	1	..	..	..	..	..	18
48–	1	1	4	1	2	..	..	1	..	..	..	..	..	..	..	..	..	..	10
50–	..	2	3	2	2	1	..	1	1	..	..	..	..	1	..	..	..	..	13
52–	..	1	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	3
54–	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
56–	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2
	4	12	24	25	18	13	13	21	13	22	17	8	4	2	2	1	..	1	200

Only one of these tables showing relationships is included in this report, but in Table II an abbreviated or condensed description of these various tables of relationships is shown. Table II contains a list of the correlation coefficients measuring these relationships. Thus we see that the correlation coefficient between income and percentage of expenditure for food is high, $r_{1\cdot4} = -0.513$, while the correlation coefficient between income and percentage of expenditure for rent is low, $r_{1\cdot5} = -0.10$. These coefficients tell us that the size of the income affects only slightly percentages of expenditure for rent, while increasing the income markedly diminishes the percentage of expenditure for food. And so the various relationships can be interpreted from the correlation coefficients.

TABLE II.

CORRELATION COEFFICIENTS.

$r_{2\cdot1} = +0.354$
$r_{3\cdot1} = +0.047$
$r_{4\cdot1} = -0.513$
$r_{5\cdot1} = -0.10$
$r_{6\cdot1} = -0.227$
$r_{7\cdot1} = +0.351$
$r_{8\cdot1} = +0.419$
$r_{9\cdot1} = +0.229$
$r_{10\cdot1} = +0.368$
$r_{11\cdot1} = +0.071$
$r_{12\cdot1} = -0.022$
$r_{13\cdot1} = +0.175$
$r_{14\cdot1} = +0.10$
$r_{15\cdot1} = +0.304$
$r_{16\cdot1} = +0.265$
$r_{17\cdot1} = -0.122$
$r_{18\cdot1} = -0.036$
$r_{19\cdot1} = -0.046$
$r_{20\cdot1} = +0.391$

$r_{2\cdot3} = -0.196$
$r_{4\cdot3} = +0.256$
$r_{5\cdot3} = -0.075$
$r_{6\cdot3} = +0.028$
$r_{7\cdot3} = +0.165$
$r_{8\cdot3} = -0.255$
$r_{9\cdot3} = -0.286$
$r_{10\cdot3} = +0.438$
$r_{11\cdot3} = +0.692$
$r_{12\cdot3} = +0.011$
$r_{13\cdot3} = -0.0284$
$r_{14\cdot3} = -0.115$
$r_{15\cdot3} = +0.0038$
$r_{16\cdot3} = -0.147$
$r_{17\cdot3} = -0.029$
$r_{18\cdot3} = -0.078$
$r_{19\cdot3} = +0.405$
$r_{20\cdot3} = -0.639$

Although the correlation coefficients show the results of the classification of items of expenditure according to income and according to size of family, perhaps a better idea can be had by expressing these relationships in equations rather than in coefficients. These equations can best be explained by observing the plotting in Diagram I.* In this chart we see from the location of the circular dots the average amount of deficit or surplus, according to size of income. The procession of circular dots shows that for very low incomes there is a large deficit and that as the income increases the deficit becomes less and less, and soon there is a surplus which increases with the income. There is considerable fluctuation of these circular dots or means, due to the fact that the sample includes only 200 cases. If the sample had been very large the procession of the means would have approximated with less fluctuation a straight line. We can determine the equation to the straight line which the dots follow. It is $X_2 = -166.45 + 0.144\ X_1$ and the plotting of it is shown in Diagram I. This "regression" equation expresses the relationship between size of income and the amount of deficit or surplus in somewhat more interpretable form than does the correlation coefficient. Thus the equation tells us that for every increase of $100 in income a year the amount of deficit is reduced $14 or the surplus is increased $14. We can also substitute in this equation any income (between $800 and $1,800 a year) and know what on the average is the amount of deficit or surplus of a family living in the District of Columbia in 1916. These results can also be read from the plotting of the line in the diagram. Thus when the income was $1,500 there was on the average a surplus of $50 and when the income was $1,155 there was, on the average, neither deficit nor surplus. Similarly the other equations in Table III show the relationship existing between the other variables.

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* This diagram was not available for the QUARTERLY, but will be published in another edition of the Author's work.—ED.

TABLE III.

REGRESSION EQUATIONS.

$X_2 = -166.45 + 0.144X_1$
$X_3 = -3.23 + 0.00016X_1$
$X_4 = 53.08 - 0.0113X_1$
$X_5 = 21.14 - 0.0013X_1$
$X_6 = 7.19 - 0.0013X_1$
$X_7 = 6.70 + 0.0035X_1$
$X_8 = 12.70 + 0.0098X_1$
$X_9 = 2.21 + 0.0013X_1$
$X_{10} = 0.50 + 0.0018X_1$
$X_{11} = 3.94 + 0.00053X_1$
$X_{12} = 4.29 - 0.00016X_1$
$X_{13} = 0.30 + 0.00054X_1$
$X_{14} = 1.81 + 0.00096X_1$
$X_{15} = 0.10 + 0.00059X_1$
$X_{16} = 0.12 + 0.00077X_1$
$X_{17} = 2.65 - 0.00076X_1$
$X_{18} = 3.44 - 0.00036X_1$
$X_{19} = 4.08 - 0.00032X_1$
$X_{20} = 0.23 + 0.00014X_1$

$X_2 = 81.09 - 24.22X_3$
$X_4 = 34.31 + 1.71X_3$
$X_5 = 20.66 - 0.297X_3$
$X^6 = 5.52 + 0.05X_3$
$X_7 = 9.03 + 0.496X_3$
$X_8 = 30.06 - 1.80X_3$
$X_9 = 5.30 - 0.47X_3$
$X_{10} = 4.73 - 0.635X_3$
$X_{11} = -0.80 + 1.57X_3$
$X_{12} = 4.03 + 0.024X_3$
$X_{13} = 1.01 - 0.026X_3$
$X_{14} = 4.07 - 0.34X_3$
$X_{15} = 0.77 + 0.0023X_3$
$X_{16} = 1.44 - 0.129X_3$
$X_{17} = 1.97 - 0.055X_3$
$X_{18} = 3.85 - 0.24X_3$
$X_{19} = 0.81 + 0.85X_3$
$X_{20} = 0.62 - 0.069X_3$

Observation of the list of equations in Table III shows them to be equations of straight lines. In other words, we have assumed that the circular dots or the means, if the sample had been sufficiently large, would have fallen on a straight line. Of course, there is no *a priori* reason why the means should follow a straight line rather than a curved line, or any other kind of line. Observation, however, of the plotting of the means of the various tables of relationships seems to show that they follow approximately a straight line, at least for incomes from $800 to $1,800. The number of cases of incomes beyond these limits are quite small and the scattering for the very low and very high incomes is quite marked. The present study is therefore most accurate for families with incomes between $800 and $1,800. In some tables the means for very high incomes seem not to follow a straight line. Thus in Diagram I in the case of size of deficit or surplus, according to size of income, perhaps the line best fitting the means would be a straight line up to $1,700 and then curving upward slightly. In most of the relationships studied, though, the straight line is a better fit than is true in the case of the data in Diagram I. However, in this diagram the straight line gives a considerably better description than the rough plotting of the means. Thus according to the means, when the income is $1,150 there is a deficit of $61, but according to the equation of the line there is no deficit or surplus when the income is $1,150. In other words, the true amount of deficit or surplus is more nearly indicated by the line than by the means, because the means fluctuate a good deal for the reason that the sample is small. So that even if the straight line is not a perfect fit, the fit is sufficiently good to give a good description. This statement is shown to be true by the following list of tests of "goodness of fit," shown in Table IV. A customary measure of the extent of divergence of the means from a straight line is the difference between the correlation ratio and the correlation coefficient, or, better still, the difference between their squares, which is usually written as ζ. If the ζ is large the fit is not very good. The size of the ζ can be estimated by comparison with its error. If three times the error is less than ζ, it is fairly certain that the straight line is not a good fit. So by comparing in Table IV the ζ's with their errors, an estimate may be made of the "goodness of fit" of a straight line to the means, for each of the relationships studied. The errors of ζ were derived from the formula, $e_\zeta = 2\sqrt{\frac{\zeta}{n}}$.

TABLE IV.

DIFFERENCES BETWEEN THE CORRELATION RATIO SQUARED AND THE CORRELATION COEFFICIENT SQUARED AND THE ERROR OF THIS DIFFERENCE.

$\zeta_{2\cdot 1}=0.1905$
$\zeta_{3\cdot 1}=0.0633$
$\zeta_{4\cdot 1}=0.0338$
$\zeta_{5\cdot 1}=0.037$
$\zeta_{6\cdot 1}=0.043$
$\zeta_{7\cdot 1}=0.0574$
$\zeta_{8\cdot 1}=0.0596$
$\zeta_{9\cdot 1}=0.1554$
$\zeta_{10\cdot 1}=0.0892$
$\zeta_{11\cdot 1}=0.0717$
$\zeta_{12\cdot 1}=0.0718$
$\zeta_{13\cdot 1}=0.0605$
$\zeta_{14\cdot 1}=0.0639$
$\zeta_{15\cdot 1}=0.0474$
$\zeta_{16\cdot 1}=0.1349$
$\zeta_{17\cdot 1}=0.022$
$\zeta_{18\cdot 1}=0.0816$
$\zeta_{19\cdot 1}=0.0288$
$\zeta_{20\cdot 1}=0.079$

$\epsilon_{2\cdot 1}=0.0616$
$\epsilon_{3\cdot 1}=0.0356$
$\epsilon_{4\cdot 1}=0.026$
$\epsilon_{5\cdot 1}=0.0272$
$\epsilon_{6\cdot 1}=0.0294$
$\epsilon_{7\cdot 1}=0.0338$
$\epsilon_{8\cdot 1}=0.034$
$\epsilon_{9\cdot 1}=0.056$
$\epsilon_{10\cdot 1}=0.042$
$\epsilon_{11\cdot 1}=0.088$
$\epsilon_{12\cdot 1}=0.038$
$\epsilon_{13\cdot 1}=0.034$
$\epsilon_{14\cdot 1}=0.036$
$\epsilon_{15\cdot 1}=0.0308$
$\epsilon_{16\cdot 1}=0.052$
$\epsilon_{17\cdot 1}=0.021$
$\epsilon_{18\cdot 1}=0.04$
$\epsilon_{19\cdot 1}=0.024$
$\epsilon_{20\cdot 1}=0.04$

$\zeta_{2\cdot 3}=0.090$
$\zeta_{4\cdot 3}=0.053$
$\zeta_{5\cdot 3}=0.1026$
$\zeta_{6\cdot 3}=0.059$
$\zeta_{7\cdot 3}=0.098$
$\zeta_{8\cdot 3}=0.059$
$\zeta_{9\cdot 3}=0.127$
$\zeta_{10\cdot 3}=0.065$
$\zeta_{11\cdot 3}=0.0409$
$\zeta_{12\cdot 3}=0.0834$
$\zeta_{13\cdot 3}=0.0699$
$\zeta_{14\cdot 3}=0.0847$
$\zeta_{15\cdot 3}=0.0324$
$\zeta_{16\cdot 3}=0.029$
$\zeta_{17\cdot 3}=0.0407$
$\zeta_{18\cdot 3}=0.0315$
$\zeta_{19\cdot 3}=0.042$
$\zeta_{20\cdot 3}=0.0775$

$\epsilon_{2\cdot 3}=0.042$
$\epsilon_{4\cdot 3}=0.033$
$\epsilon_{5\cdot 3}=0.045$
$\epsilon_{6\cdot 3}=0.034$
$\epsilon_{7\cdot 3}=0.044$
$\epsilon_{8\cdot 3}=0.034$
$\epsilon_{9\cdot 3}=0.052$
$\epsilon_{10\cdot 3}=0.036$
$\epsilon_{11\cdot 3}=0.028$
$\epsilon_{12\cdot 3}=0.04$
$\epsilon_{13\cdot 3}=0.036$
$\epsilon_{14\cdot 3}=0.04$
$\epsilon_{15\cdot 3}=0.0254$
$\epsilon_{16\cdot 3}=0.024$
$\epsilon_{17\cdot 3}=0.028$
$\epsilon_{18\cdot 3}=0.025$
$\epsilon_{19\cdot 3}=0.029$
$\epsilon_{20\cdot 3}=0.0394$

The correlation coefficients and the regression equations may at times give misleading information, for the reason that they measure the relationship between only two variables, whereas there may be a very important third variable related, which must be taken into consideration before we can get the real meaning. For instance, we see from the fact that $r_{3\cdot 2}=-0.196$, in Table II, that the larger the family the less the surplus or the greater the deficit. But we know that the size of the income has a good deal to do with whether there is a surplus or a deficit. What we really want to know is what is the degree of correlation between size of family and deficit or surplus for a constant income. The coefficient $r_{3\cdot 2}$ doesn't tell us anything about the income; but we can find out the relationship between size of family and deficit or surplus with a constant income, by using the method of partial correlation. Using this method we find ${}_1r_{3\cdot 2}=-0.228$, in Table V, which means that with a constant income the correlation between income and deficit or surplus is somewhat greater than when we measure the correlation, irrespective of whether the income is constant.

Taking another illustration, we see from the fact that $r_{3\cdot 15}=+0.0038$, that the larger the family the more is spent for such educational purposes as newspapers, magazines and books. But we also know that the larger the income the more is spent for such purposes. Now if larger families have larger incomes, the correlation $r_{3.15}$ instead of showing that larger families spend more for educational purposes *may* mean really that families with larger incomes spend more for educational purposes, because large families have larger incomes. This seems to be the case for $r_{1.3}$ (income and size of family) equals $+0.047$, and $r_{1.15}$ (income and education) equals $+0.0304$, and the partial correlation coefficient ${}_1r_{3.15}$, a correlation between size of family and percentages of expenditures for educational purposes with a constant income, equals -0.011. In other words, with the income unchanged, an increase in family is accompanied with a smaller percentage of expenditures for newspapers, magazines and books, which is the opposite of what seemed to be the case when we considered the relationship between income and expenditure for these purposes, considering income as a factor ($r_{3.15} = +0.0038$). The correlations just considered are very small but they illustrate the idea in partial correlation.

From these illustrations it is seen that we really want to know the relationships between income and expenditure for various purposes, with the size of the family kept constant, and also the relationships between size of family and expenditure for various purposes, with the income kept constant. The partial coefficients of correlation in Table V give us this information, and are therefore less misleading in information than the simple correlation coefficients.

The part of the list of partial coefficients of correlation between income and various items of expenditure with the size of the family kept constant, is a sort of chart showing the satiability of human wants. Where the sign of the correlation coefficient is negative the desires seem to be more quickly satisfied, while the large positive correlations indicate the desires that are capable of somewhat greater expansion. Thus the desire for food is not capable of very great expansion and $r_{1.4} = -0.513$. This is not so true of the desire for clothes and in this case $r_{1.7} = +0.351$.

Also the latter half of the list of partial coefficients of correlations, showing correlations between size of family and various expenditures with an income kept constant, is a very

TABLE V.

PARTIAL CORRELATION COEFFICIENTS.

$_3r_{2\cdot1} = +0.371$
$_3r_{4\cdot1} = -0.544$
$_3r_{5\cdot1} = -0.0965$
$_3r_{6\cdot1} = -0.228$
$_3r_{7\cdot1} = +0.349$
$_3r_{8\cdot1} = +0.447$
$_3r_{9\cdot1} = +0.253$
$_3r_{10\cdot1} = +0.432$
$_3r_{11\cdot1} = +0.0542$
$_3r_{12\cdot1} = -0.022$
$_3r_{13\cdot1} = +0.177$
$_3r_{14\cdot1} = +0.106$
$_3r_{15\cdot1} = +0.305$
$_3r_{16\cdot1} = +0.275$
$_3r_{17\cdot1} = -0.121$
$_3r_{18\cdot1} = -0.033$
$_3r_{19\cdot1} = -0.03$
$_3r_{20\cdot1} = +0.549$
$_1r_{2\cdot3} = -0.228$
$_1r_{4\cdot3} = +0.327$
$_1r_{5\cdot3} = -0.0708$
$_1r_{6\cdot3} = +0.039$
$_1r_{7\cdot3} = +0.159$
$_1r_{8\cdot3} = -0.302$
$_1r_{9\cdot3} = -0.305$
$_1r_{10\cdot3} = -0.49$
$_1r_{11\cdot3} = +0.6925$
$_1r_{12\cdot3} = -0.012$
$_1r_{13\cdot3} = -0.0375$
$_1r_{14\cdot3} = -0.121$
$_1r_{15\cdot3} = -0.011$
$_1r_{16\cdot3} = -0.165$
$_1r_{17\cdot3} = -0.242$
$_1r_{18\cdot3} = -0.076$
$_1r_{19\cdot3} = +0.408$
$_1r_{20\cdot3} = -0.7157$
$_{1\cdot3}r_{16\cdot5} = -0.182$
$_{1\cdot3}r_{12\cdot16} = +0.239$
$_{1\cdot3}r_{13\cdot19} = -0.073$
$_{1\cdot3}r_{13\cdot16} = -0.081$
$_{1\cdot3}r_{13\cdot25} = -0.0822$
$_{1\cdot3}r_{15\cdot16} = +0.054$
$_{1\cdot3}r_{16\cdot19} = -0.121$
$_{1\cdot3}r_{17\cdot28} = -0.138$
$_{1\cdot3}r_{19\cdot20} = +0.046$

good indication of what happens when the family increases and the income does not. The negative coefficients of correlations show the particular curtailment and the degree of curtailment that is made necessary. The information of this table no doubt helps to explain why the birth rate has declined.

Several references have been made to correlating the size of the family, and no doubt the question has arisen in the mind of the reader as to what measure of the size of the family was used. In order to classify according to size of family, it was necessary to find some measure of the size of the family other than the number of persons in the family. A somewhat better unit is that used in analysis of food consumption, in which children and women are considered as various fractions of an adult male; the particular fractions are determined on the basis of the respective calory requirements of the particular individuals. Thus, the Bureau of Labor Statistics rates the adult male as 1.0, the wife as 0.9, child over 14 years as an adult, child from 11 to 14 years as 0.9, child from 7 to 10 years as 0.75, child from 4 to 6 years as 0.4 and child under 3 years as 0.15. This scale is certainly a better unit of measure of the size of the family than the number of persons in the family. Such a scale has been accepted as an index of the size of the family when studying food requirements and food expenditures. But is it also a good index of the size of family when studying clothing expenditures, rent, expenditures for fuel, light and sundries?

It is possible to find out what is the proportion of expenditure for clothing for the wife and for children of various ages, as compared with the proportion for the adult male. If this is done we can then compare the fractions which the children's and wife's clothing is of the adult male's with the fractions which the children's and wife's calory requirements is of the adult male's requirements. This will furnish an idea of whether the unit of measure of size of family, based on food requirements, is a good measure when we study clothing expenditure. This has been done and has been generalized in such a way as to show on the average what size a family will be when measured in units of clothing expenditure in terms of the adult male as compared with the same family expressed in units of calory requirements in terms of the adult male. These data show a very close correspondence between these two units of measure for size of family, as shown in the equation $X_{19} = 0.81 + 0.85X_3$. Thus when the equivalent adult males in calory requirements are 3, the total clothing expenditure in multiple of the expenditure for the husband's clothes is on the average 3.3, when the equivalent adult males in calory requirements are 4, the corresponding figure in clothing requirements is 4.2, when the equivalent adult males in calory requirements are 5, the corresponding figure in clothing requirements is 5.1, and where the equivalent adult males in calory requirement are 6, the corresponding figure in clothing requirements is 5.9.

This relationship can be expressed in the following terms: when the size of the family, measured in these units based on food requirements, is increased by 1 unit, the average size of the family in units based on clothing expenditures is increased on the average by 0.85 units. We think then that the units of equivalent males, based on food needs, is a good measure of the size of the family, when considering clothing expenditures. These two expenditures include more than 50 per cent. of the total expenditures.

In a recent article in the U. S. Public Health Reports* the authors discuss the unit of the measure of the size of the family and state that a study was made in 1917 among families in cotton mill villages, but that "while the tabulations of these data have not been completed it is indicated that the Atwater scale is roughly indicative of the variations, according to sex and age in the consumption of all articles for which there are individual expenditures." In this article there is also a table computed from data collected by the U. S. Bureau of Labor Statistics in 1911, which shows that the expenditures of other members of the family bear about the same ratios to the husband's expenditure as their calory requirements do to the calory requirements of the husband, thus strengthening the value of the calory scale as a measure of the size of the family. So in this study of the District of Columbia the calory scale of the U. S. Bureau of Labor Statistics was used as a measure of the size of the family.

Just as the correlation coefficients did not yield the information they appeared at first glance to yield, because of the disturbance of other factors, income and size, and it was found desirable to determine the partial coefficients of correlation which showed a relationship when these disturbing factors were kept constant; so the regression equations may be slightly deceptive at first glance, and we need to determine the partial regression equations. For instance from equation, $X_{11}=3.94-0.00053\ X_1$, in Table III, we see that an increase of income of $100 increases the average percentage of expenditure for children's clothing by 0.053 per cent., but it may be that with the size of the family kept constant, the increase in percentage of expenditure for children's clothing for every $100 increase in income will not be so much. And this is true, for from equation, $X_{11}=-1.17+0.000286\ X_1+1.58\ X_2$, in Table VI, an equation in such a form that we can keep the factor, size of family, constant, we see that for every increase in income of $100 the percentage of expenditure for children's clothing increases only 0.0286 per cent., or about one half what appeared to be the increase when we did not keep the size of the family constant. These partial regression equations enable us to keep the size of the family constant and tell what percentage of increase (or decrease) accompanies a change of income of any amount. Similarly, they enable us to keep the size of income constant and tell what percentage of increase (or decrease) accompanies a change of any size in the family. These equations then give us the maximum amount of accurate specific information about items of expenditure for various sizes of income and various sizes of family. In other words, we can tell from these equations what a family of any size with an income of any size (between $800 and $1,800) spends, on the average, on the various items of expenditure studied in the year 1916 in the District of Columbia.

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* "Disabling Sickness among the Population of Seven Cotton Mill Villages of South Carolina in Relation to Family Income," by Sydenstricker, Wheeler, and Goldberger. Vol. XXXIII, No. 47, November 22, 1918.

TABLE VI.

PARTIAL REGRESSION EQUATIONS.

(1) $X_3 = -82.70 + 0.14921X_1 - 24.31X_2$ (Deficit and surplus)
(2) $X_4 = 47.00 - 0.01158X_1 + 1.88X_2$ (Food)
(3) $X_5 = 22.03 - 0.00125X_1 - 0.28X_2$ (Rent)
(4) $X_6 = 7.00 - 0.00134X_1 + 0.066X_2$ (Fuel and light)
(5) $X_7 = 5.29 + 0.003407X_1 + 0.449X_2$ (Clothing)
(6) $X_8 = 19.00 + 0.01008X_1 - 1.94X_2$ (Sundries)
(7) $X_9 = 3.88 + 0.00134X_1 - 0.50X_2$ (Husband's clothing)
(8) $X_{10} = 2.69 + 0.00185X_1 - 0.66X_2$ (Wife's clothing)
(9) $X_{11} = -1.17 + 0.000286X_1 + 1.58X_2$ (Children's clothing)
(10) $X_{12} = 4.20 - 0.000168X_1 + 0.026X_2$ (Life insurance)
(11) $X_{13} = 0.41 + 0.00054X_1 - 0.034X_2$ (Religion)
(12) $X_{14} = 2.95 + 0.00101X_1 - 0.353X_2$ (Furniture)
(13) $X_{15} = 0.13 + 0.00059X_1 - 0.0062X_2$ (Education)
(14) $X_{16} = 0.58 + 0.00079X_1 - 0.141X_2$ (Amusement)
(15) $X_{17} = 4.20 - 0.00076X_1 - 0.456X_2$ (Liquor and tobacco)
(16) $X_{18} = 4.20 - 0.00033X_1 - 0.238X_2$ (Sickness)
(17) $X_{19} = 1.01 - 0.00019X_1 + 0.857X_2$ (Equiv. ad. males in clothing ex.)
(18) $X_{20} = 0.47 + 0.000148X_1 - 0.071X_2$ (Food ex. per man per day)

In regard to errors, the coefficients of correlation less than ±0.2 are not significant. When the amounts of expenditure for food, rent, etc., are computed from regression equations based on correlations with the actual amounts spent, these amounts thus computed are usually within plus or minus two percent of the respective amounts computed from regression equations based on correlations with percentages of expenditure. The errors of the coefficients in the partial regression equations of Table VI are listed in Table VII. They were derived from the formula,

$$\epsilon_{{}_3b_{2\cdot 1}} = \frac{\sigma_2(1-r^2_{1.2})^{\frac{1}{2}}(1-{}_1r^2_{2.3})^{\frac{1}{2}}}{\sigma_1 n^{\frac{1}{2}}(1-r^2_{1.3})^{\frac{1}{2}}}.$$

The means and standard deviations are listed in Table VIII.

TABLE VII.

ERRORS OF THE REGRESSION COEFFICIENTS OF THE PARTIAL REGRESSION EQUATIONS.

${}_{3}e_{2\cdot1}=0.0259$	${}_{3}e_{12\cdot1}=0.0005$	${}_{1}e_{2\cdot3}=7.96$	${}_{1}e_{12\cdot3}=0.154$
${}_{3}e_{4\cdot1}=0.0012$	${}_{3}e_{13\cdot1}=0.0002$	${}_{1}e_{4\cdot3}=0.384$	${}_{1}e_{13\cdot3}=0.064$
${}_{3}e_{5\cdot1}=0.0009$	${}_{3}e_{14\cdot1}=0.0006$	${}_{1}e_{5\cdot3}=0.278$	${}_{1}e_{14\cdot3}=0.205$
${}_{3}e_{6\cdot1}=0.000405$	${}_{3}e_{15\cdot1}=0.00001$	${}_{1}e_{6\cdot3}=0.123$	${}_{1}e_{15\cdot3}=0.00398$
${}_{3}e_{7\cdot1}=0.0006$	${}_{3}e_{16\cdot1}=0.000019$	${}_{1}e_{7\cdot3}=0.196$	${}_{1}e_{16\cdot3}=0.0595$
${}_{3}e_{8\cdot1}=0.00014$	${}_{3}e_{17\cdot1}=0.00042$	${}_{1}e_{8\cdot3}=0.433$	${}_{1}e_{17\cdot3}=0.133$
${}_{3}e_{9\cdot1}=0.0003$	${}_{3}e_{18\cdot1}=0.0007$	${}_{1}e_{9\cdot3}=0.110$	${}_{1}e_{18\cdot3}=0.216$
${}_{3}e_{10\cdot1}=0.00027$	${}_{3}e_{19\cdot1}=0.00044$	${}_{1}e_{10\cdot3}=0.0832$	${}_{1}e_{19\cdot3}=0.136$
${}_{3}e_{11\cdot1}=0.00038$		${}_{1}e_{11\cdot3}=0.116$	

TABLE VIII.

MEANS AND STANDARD DEVIATIONS.

$M_1=1145.5$	$M_{11}=4.55$	$\sigma_1=350$	$\sigma_{11}=2.619$
$M_2=+1.5$	$M_{12}=4.11$	$\sigma_2=142.10$	$\sigma_{12}=2.515$
$M_3=3.41$	$M_{13}=0.92$	$\sigma_3=1.146$	$\sigma_{13}=1.072$
$M_4=40.14$	$M_{14}=2.91$	$\sigma_4=7.70$	$\sigma_{14}=3.377$
$M_5=19.65$	$M_{15}=0.78$	$\sigma_5=4.548$	$\sigma_{15}=0.58$
$M_6=5.69$	$M_{16}=1.00$	$\sigma_6=2.055$	$\sigma_{16}=1.017$
$M_7=10.72$	$M_{17}=1.78$	$\sigma_7=3.465$	$\sigma_{17}=2.188$
$M_8=23.92$	$M_{18}=3.03$	$\sigma_8=8.136$	$\sigma_{18}=3.525$
$M_9=3.70$	$M_{19}=3.71$	$\sigma_9=1.936$	$\sigma_{19}=2.416$
$M_{10}=2.56$	$M_{20}=0.39$	$\sigma_{10}=1.67$	$\sigma_{20}=0.124$

In Table VI, equations, numbers 2, 3, 4, 5 and 6 may be said to express the well-known Engel's laws in mathematical form, as found in the District of Columbia in 1916. Engel's first law is: As the income of a family increased a smaller percentage of it was expended for food. Our equation is quite in conformity and is: $X_4=47.00-0.01158\ X_1+1.88X_3$, where X_3 is the size of the family measured in the scale of calory requirements, and X_1 is annual income, and X_4 is the percentage of expenditure for food. His second law is: As the income of a family increased, the percentage of expenditures for clothing remained approximately the same. The equation, $X_7=5.29+0.003407\ X_1+0.449\ X_3$, shows that the percentage of expenditure for clothing rises as the income increases. The third law is: With all the incomes investigated, the percentage of expenditure for rent, fuel and light remained invariably the same. Equations number 3 and 4 in Table VI show that for this study the percentage of expenditure for rent falls slightly, as does also and at the same rate the percentage of expenditure for fuel and light. The fourth law was: As the income increased in amount a constantly increasing percentage was expended for education, health, recreation, amusements, etc.

This was also true in the present study as is shown by the equation, $X_8=19.00+0.01008\ X_1-1.94\ X_2$. These equations may be said to express Engel's laws quantitively.

Another possible value to these equations is that they make possible comparisons in cost of living in the cities for which they are computed. For instance, the U. S. Bureau of Labor Statistics found in a study of Portland, Me., that certain amounts were on the average spent for food, for clothing, for rent, for fuel and light, and for sundries, these amounts being for an average family of 4.2 equivalent adult males and with an average annual income of $1,335. Similar amounts of expenditure were found for Boston, but there the average family was 3.8 equivalent adult males and the average annual income was $1,520. Should it be desirable to make comparisons between the cost of living in the two places from these data, comparisons could not be made because the incomes are of different sizes and the families are also of different sizes. With such equations, however, the amounts of various expenditures for each place could be reduced to a base of the same income and the same sized family, and comparisons should be made as to the cost of living.

The equations also make it possible to tell what a family of any size and of any income (between $800 and $1,800) will spend on a variety of items of family expenditure. Thus if a family of any income and any size wanted as a guide an average budget showing distribution of expenditure, it could be easily constructed from the partial regression equations. Thus a family of husband, wife, and children of ages 4, 6 and 8 years, with an income of $1,155 a year, spent in 1916 on the average $462 for food, $227 for rent, $66 for fuel and light, $124 for clothing, and $277 for sundries (including all other expenditures). The husband spent $43 for clothes, the wife $30 and for the children there was spent $52; $47 was spent for insurance, $11 for religious purposes, $34 for furniture and furnishings, $9 for newspapers, magazines and books, $12 for such amusements as movies, theatres, pool, and dances, $20 for liquor and tobacco and $35 for sickness.

The effect of a growing family without an increase of income can be told quite specifically from these equations. Suppose a husband, wife, and three children aged 1, 3 and 5 years have not had an increase of income in three years, still remaining at $1,000, then they will readjust their expenditures in the following manner, assuming they do not go in debt, that there has been no more children and that there has been no substantial change in the price level. They will spend $25 a year more for food, $4 less for rent and $25 less for sundries. The husband will spend $6 less for his clothing, the woman $8 less for hers and the children $19 more for theirs. The amount spent for fuel and light, insurance and religious purposes will be about the same. They will spend $4 less for furnishings, $2 less for newspapers and magazines, $2 less for movies, theatres and similar amusements, $5 less for liquor and tobacco and $3 less for sickness.

A few other conclusions of interest may be drawn from the equations in Table VI.

As the income goes down the percentage of expenditure for women's clothing diminishes most, and for children's clothing least, and as the income goes up the percentage of expenditure for women's clothing increases most and for children's least. In this regard women seem to sacrifice most and the children least.

In families of husband, wife and children of ages 4, 6 and 8 years, with an income of $1,155, the wife's clothing costs 70 per cent. as much as the husband's clothing.

For purposes of comparison with other budgetary studies, it is desirable to state the percentages of expenditure found in this study of the District of Columbia for the year 1916. For a family of husband, wife and children of ages 4, 6 and 8 years, with an income of $1,155, the following percentages of expenditure were allowed:

Food	40 per cent.
Rent	19 per cent.
Fuel and light	6 per cent.
Clothing	11 per cent.
Sundries	24 per cent.
Total	100 per cent.

An average family of man, wife and three children, of ages 4, 6 and 8 years, in the District of Columbia in 1916, was in debt, if the annual income was less than $1,155.

REMARKS ON W. F. OGBURN'S PAPER—ANALYSIS OF THE STANDARD OF LIVING IN THE DISTRICT OF COLUMBIA, 1916.*

By E. A. Goldenweiser.

Professor Ogburn's admirable paper has been peculiarly helpful to me because for many years I have read accounts of budgetary investigations and at one time I was guilty of one myself, and all through this period I have always wondered what they were for.

They do not exactly help to determine a minimum wage because the family budget often consists of more than one wage. They do not give an adequate idea of standards of living because a standard is one thing and the ability to live up to it is another ("My poverty, but not my will, consents") and, finally, budgetary studies frequently do not portray existing conditions in a representative manner for a variety of reasons. In the first place, it is difficult to select a representative group. Very frequently the fact that one can obtain budgetary studies from a group indicates that it is more methodical than the average in system but perhaps below the average in self-respect. In the second place, a member of the family, from his or her imperfect knowledge of the family expenditures, makes a more or less conscientious effort to give the canvasser the desired information. The canvasser, more or less experienced, understands the interviewed person with a considerable margin of approximation. He puts the figures down on his questionnaire, rounding them off to a certain degree. Later the schedule goes through the hands of an editor who amends it still further to make it consistent with itself and only too frequently with his own idea of what the budget ought to be. Later the tabulator goes through the schedules and takes out their substance more or less accurately. Finally, the person who writes the report rounds the figures off still further, computes averages, and draws conclusions based in part on the figures themselves but even more largely on his social philosophy. Then the data are published, reviewed in the Survey, and relegated to the shelves of libraries. Such has been my experience of budgetary studies for many years.

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* Paper read at the Eighteenth Annual Meeting of the American Statistical Association.

Dr. Ogburn manages the matter in a different way. His paper, as read here, deals with conclusions and social interpretations in an incidental manner. His main idea is to present to us a method of analysis, and the method, in so far as I am able to judge, is an admirable one and one that might serve to put new life into the numerous and largely futile budgetary studies which are endemic in the Unites States. By the method of correlation and of regression the author indicates ways in which budgetary studies can be made significant interpretations of social and economic conditions.

By selecting fairly uniform units, namely, families consisting of a husband and a wife with not more than three children, with an income not exceeding $1,800 a year, among whom the husband's earnings constituted not less than 75 per cent. of the total family income, he has made the statistics gathered by the Bureau of Labor Statistics sufficiently homogeneous for scientific analysis. It is interesting to note that out of 2,110 budgets collected only 200 qualified under his test. On the basis of these 200 Dr. Ogburn makes a study which shows in a mathematical and scientific way that Engel's law, formulated a half century ago, is still substantially valid at the present time in the District of Columbia, or, more properly, was valid in the District of Columbia in 1916—for no one knows what changes have occured since 1916. This well known law, states that as a family income increases a smaller proportion is expended for food, about the same percentage is expended for clothing, and the expenditures for rent, fuel and light remain unchanged, while a constantly increasing percentage is expended for education, health, recreation, amusements, etc. This law is not only in the main substantiated by the present paper but is given quantitative values. In other words, we know to what extent the expenditure for food declines, relatively, with a decreasing income and to what extent the comforts and luxuries and cultural expenditures increase. This confirmation of an old law and the infusion of quantitative values into it is a distinct contribution, as it makes it possible for the legislator and economist to see clearly where the pressure will be felt if an element of the population is underpaid.

Dr. Ogburn shows, for instance, that a family of the type he studied cannot exist in the District of Columbia without going into debt on less than $1,155 a year. He shows that one of the first things to suffer is the clothing of the women, that the children are affected least, that the women spend only three-fourths as much for their clothes as do the men, etc. In the bulletin, which I understand is to be published by the Bureau of Labor Statistics, and in which these matters are dealt with in much greater detail, a great many other conclusions will doubtless be given and they will be of distinct value to students.

Not in a spirit of criticism, but in one of hesitancy, the question still rankles in my mind—will this refined method of mathematical interpretation be of real substantial value in overcoming the paucity and essential unreliability of the data? A man of Dr. Ogburn's scholarship is capable of selecting 200 cases out of 2,000 and of extracting from them social data of real significance. But will this sharp-edged tool of mathematical interpretation not be a dangerous one in the hands of the average investigator, and will not the semblance of scientific method add prestige to a great deal of material that on its own merits may not deserve much consideration?

Far be it from me to detract from Dr. Ogburn's service, but the suggestion occurs to me that in giving his method to the public he should introduce it with a warning—"to be used only by competent adults."

IS THE NEW IMMIGRATION MORE UNSKILLED THAN THE OLD?

By Paul H. Douglas.

It is commonly stated that the newer immigration from Southeastern Europe is more unskilled than the older immigration from Northwestern Europe.* This has been challenged by a few writers,† but it has not by any means been effectually refuted.

The purpose of this article is to consider the question of the relative skill of the new and the old immigrants when they enter this country. The varying occupations which these two classes have assumed *after* they have once entered the country will not be treated.

I.

Nature of the Problem

The statement that the new immigration is more unskilled than the old is based on the following table in Jenks and Lauck's "The Immigration Problem," page 32.

This table apparently proves that the percentage of skilled workers in the old immigration is more than twice as great as in the new; 19.5 per cent. in the former, 8.9 per cent. in the latter. The table, however, contains certain statistical fallacies. (1) Hebrews are excluded from the classification of the newer immigrants.‡ This gives a hand-picked table, as the Jews are the most highly skilled of all the newer races. To omit them from the category of the "new immigration"

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* For a statement of this viewpoint see Jenks and Lauck, "The Immigration Problem," pp. 31–33.

† Notably by I. A. Hourwich, in "Immigration and Labor," see especially pp. 67–68. "The old immigrants as well as those of the present generation were mostly unskilled laborers and farm-hands." The evident intent of the author to make out a case for the newer immigrants, together with the frequent use of the *post hoc ergo propter hoc* doctrine, has led some impartial students of the question to discredit the value of his conclusions.

‡ Another table is given in the Immigration Commission Report, Vol. 1, p. 174, in which Hebrews are included. This table, however, is not copied by Jenks and Lauck. For a study of the Jewish immigration see Samuel Joseph, "Jewish Immigration to the United States," pp. 140–145, where an occupational analysis is given.

TABLE I.

OLD AND NEW EUROPEAN IMMIGRATION (INCLUDING SYRIANS) TO THE UNITED STATES (HEBREWS EXCEPTED) FOR THE PERIOD 1899–1909, INCLUSIVE, CLASSIFIED BY OCCUPATIONS.

(Compiled from United States Immigration Commission Reports.)

Occupation	Number of Persons		Per Cent.	
	Of the Old Immigration	Of the New Immigration	Old Immigration	New Immigration
Professional	56,406	17,080	2.5	0.3
Skilled laborers	442,754	441,984	19.5	8.9
Farm laborers	138,598	1,142,064	6.1	23.1
Farmers	40,633	42,605	1.8	0.9
Common laborers	402,074	1,814,180	17.7	36.7
Servants	424,698	403,784	18.7	8.2
No occupation	678,510	1,041,049	29.8	21.0
Miscellaneous	90,109	46,324	4.0	0.9
Total	2,273,782	4,949,070	100.0	100.0

would be equivalent to omitting the English or the Germans from the "old." (2) A more important defect is the years chosen as a basis for comparison. The new and the old immigration are compared for the same period of time—1899–1909. We should compare the immigration from Northwestern Europe *at a previous period*, when it was the dominant element, with the newer immigration during the years 1899–1909. Because the old immigration has numbered more skilled laborers for the past few years, it does not follow that it *did* include more skilled workers in previous years. Such a statement would be justified only if the tacit assumption that the make-up of the older immigration had not changed in the mean time were true. The Immigration Commission and Jenks and Lauck are therefore guilty of bad logic when, after comparing the two immigrations for the same period of time, they conclude "that the new immigration is much more difficult to assimilate than the old because of these characteristics of occupation."†

The truth is that the terms, "new" and "old" immigration, have been carelessly and ambiguously used. They have been used: (1) to differentiate between the peoples from Northwestern Europe, who formerly comprised the bulk of immigration, and the peoples of Southeastern Europe, who now constitute its chief element; (2) as a time relationship—as a comparison between the immigration of one period with the immigration of an earlier one.

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† Jenks and Lauck, *op. cit.* p. 33.

Confusion has resulted because the Immigration Commission failed to define these terms carefully. After comparing the two sources of immigration in accordance with the first meaning, it employed the results as applicable to the second sense as well.

In order to form a valid conclusion as to whether the immigration of the last few years is more unskilled than was the immigration of former times, it is necessary to compare the figures covering the occupational characteristics of the immigration from Southeastern Europe for the period 1899–1909, not with the immigration from Northwestern Europe for the same period, but with the figures for an earlier period before the flood of immigration from Southeastern Europe began. This gives a common basis for comparison—namely, when each constituted the chief element in immigration.

The years 1871–1882, inclusive, are typical of the conditions when the immigration from Northwestern Europe was predominant, and are comparable to the period 1899–1909 for the so-called "newer" immigration. For it was not until 1885 that the source of European immigration changed appreciably.* They also include the prosperous years of 1871–1872, the crisis of 1873, and the recovery in the late 70's and the early 80's.

The relative skill of these two immigrations can be compared on two bases. First, what percentage do the skilled workers form of the total number of immigrants in each group? Secondly, what percentage do they form of those who already have occupations (or the total number minus those without occupations). Both of these bases will be used in turn.

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* The Immigration Commission uses the year 1883 as the dividing point between the supremacy of the two elements. The years 1871–1882 consequently fall within the earlier period.

II.

COMPARISON ON THE BASIS OF TOTAL IMMIGRATION.

The following table for the years 1871–1882 includes the following twelve countries: England, Scotland, Wales, Ireland, Germany, Austria, Switzerland, France, Denmark, Norway, Sweden, and Canada.* This covers all the countries of Northwestern Europe. The sources for the table are the annual reports on Immigration as found in the reports of the Bureau of Commerce and Navigation. These contain a wealth of statistical material about the previous occupation of the immigrants. Definitions of the terms "professional," "skilled," "unskilled," and "miscellaneous" are found below.†

* Canadian immigration is included because its English and French-Canadian constituents are ethnically and economically closely akin to the English and the French.

† The legitimacy of comparison may be tested by comparing the various classes as defined by the Immigration Commission and by this study. Unskilled occupations are those of servants, common laborers, farmers, and farm laborers.

1. *Servants.* This includes only one occupational group in both investigations, and is therefore easy to compare.

2. *Common laborers.* This includes only one occupational group and presents no difficulties.

3. *Farmers and farm laborers.* The Immigration Commission makes two classes of this group. The Annual Reports of the Bureau of Commerce and Navigation, 1871–1882, however, did not distinguish between them. Since the difference between the two classes is one of economic advantage, not of industrial skill, no harm is done by combining them.

4. *Professional.* The following principal occupations are included under this head:

Actors, architects, artists, authors, chemists, clergymen, dentists, druggists, editors (journalists), engineers (civil), engravers (wood-engravers), interpreters, inventors, lawyers, lecturers, lithographers, musicians, officers (civil, army, navy), physicians, reporters, scientific men, sculptors, surgeons, teachers, veterinary surgeons, actuaries, auctioneers, bankers, brokers, managers (superintendents), nurses, showmen, sisters of charity (nuns), students.

5. *Skilled laborers.* The Immigration Commission defines skilled laborers as "persons whose work is less physical but still manual and who may be highly skilled as carpenters, stone-masons, tile-setters, painters, blacksmiths, mechanics, tailors, and the like." (Abstracts of Reports U. S. Immigration Commission, Vol. II., p. 758.)

The following are the principal trades included in "skilled labor" in this study:

Burnishers, butchers, button-makers, cabinet-makers, calendrers, calico-printers, calkers, cap-makers, carders, card-makers, carpenters and joiners, carriage-trimmers, carvers and gilders, casters, cement-makers, clerks, clothiers, coach-builders, color-grinders, comb-makers, confectioners, coopers, coppersmiths, cork-cutters, cotton manufacturers, cutlers, decorators, designers, die-sinkers, distillers, draughtsmen, dressmakers, dyers, embroiderers, engine-makers, engineers, fancy goods makers, foremen, fishhook-makers, flax-dressers, flour-makers, frame-makers, fringe-makers, furnace-men, furriers, gardeners, gas fitters, gas manufacturers, glass-workers, glaziers, glove-makers, gunsmiths, hackle-makers, ham-curers, hatters, hosiers, instrument-makers, iron-dressers, iron-founders, iron manufacturers, iron-moulders, iron-puddlers, iron-turners, iron-workers, ivory-workers, jewelers, lace manufacturers, lamp-makers, lapidaries, linen manufacturers, lock smiths, loom-repairers, millwrights, miners, musical instrument makers, nail-makers, operatives (cotton), opticians, packers, painters, paperhangers, paper-makers, paper-stainers, pattern-makers, pearl-divers, The method of classification employed, it is believed, makes the results comparable with those for the later period as classified by the Immigration Commission.

TABLE II.

TOTAL IMMIGRATION FROM NORTHWESTERN EUROPE (INCLUDING CANADIANS) FOR THE PERIOD 1871–1882, INCLUSIVE, CLASSIFIED BY OCCUPATIONS.

Occupation	Number	Per Cent.
Professional	30,515	0.8
Skilled laborers	420,822	11.4
Farmers and farm laborers	372,986	10.1
Common laborers	714,924	19.3
Servants	143,587	3.9
Miscellaneous	93,938	2.5
Not stated	58,832	1.6
Total with occupations	1,835,508	49.6
Total without occupations	1,865,205	50.4
Total immigration	3,700,713	100.0

Compare this with the following table covering the immigrants from Southeastern Europe who entered the United States during the years 1899–1909, inclusive.

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pipe-makers, plasterers, plate-layers, platers, polishers, plumbers, potters, printers, refiners, riggers, rope-makers, saddlers, harness-makers, safe-makers, sail-makers, sawyers, sealing-wax makers, seamstresses, shipwrights, shoemakers, slaters and tilers, smelters, spinners, stay and corset makers, steel manufacturers, stonecutters, tailors, tallow-chandlers, tanners and curriers, telegraphers, tenters, thatchers, tile-makers, tinkers, tin-dressers, tinners, tin-platers, tobacco manufacturers and dealers, tool-grinders, tool-makers, toy-makers, truss-makers, twisters, umbrella-makers, undertakers, upholsterers, varnish-makers, vine-growers, vulcan-workers, watch and clock makers, weavers, wheel-wrights, whitesmiths, wire manufacturers, wire-workers, wool-dressers, woolen manufacturers, wool-sorters, accountants (bookkeepers, cashiers), bakers, barbers, basket-makers, belt-makers, blacksmiths, bleachers, block-cutters, block-makers, block-printers, boat-builders, boiler-makers, bookbinders, bootfitters, bottlers, brass-workers, brewers, brick-makers, broom and brush-makers, builders, coachmen, cooks, foresters, railroad men.

6. *Other occupations.* This is parallel with the "Miscellaneous" class of the Immigration Commission. It includes the following occupations: Agents (factors), bar-keepers, bird-dealers, boat and barge men, book-sellers (stationers), capitalists (proprietors), card-master n. o. d., cattle-dealers, cellar-men, chimney-sweepers, contractors, curriers, dairymen, fishermen, fruit-dealers, grocers, heaters n. o. d., horse-dealers, hotel-keepers, hunters, iron-dealers, jockeys, launderers, laundresses, lumbermen, masters n. o. d., merchants n. o. d., midwives, outfitters, peddlers, publishers, quarrymen, salesmen, scourers, shepherds, soldiers, speculators, teamsters, trainers n. o. d., travelers (commercial), travelers n. o. d., watchmen, wood-cutters.

TABLE III.

TOTAL IMMIGRATION FROM SOUTHEASTERN EUROPE (INCLUDING SYRIANS) FOR THE PERIOD 1899–1909, INCLUSIVE, CLASSIFIED BY OCCUPATIONS.

(From Report of United States Immigration Commission, 1911, Volume 1, page 174.)

Occupation	Number	Per Cent.
Professional	23,916	0.4
Skilled laborers	804,920	16.6
Farm laborers	1,151,697	19.4
Farmers	43,513	0.7
Common laborers	1,880,491	31.7
Servants	465,895	7.8
Miscellaneous	82,543	1.4
No occupation	1,486,777	25.0
Total	5,939,252	100.0

Thus while only 11.4 per cent. of the earlier immigrants from Northwestern Europe were skilled, the later immigration from the Slavic and Mediterranean countries had 16.6 per cent. of its number skilled workmen. If we choose the total immigration as the base upon which the occupational distribution must be computed, we are then forced to conclude that the "new immigration," instead of being less skilled, is really more skilled than the "old immigration." Incidentally it may be said that Jenks and Lauck used this base; so judging by their standards, their conclusions must be held to be erroneous.

III.

COMPARISON ON THE BASIS OF IMMIGRANTS WITH OCCUPATIONS.

There is a very strong objection to a comparison based on the total immigration. Though the older immigration has apparently fewer skilled craftsmen relatively than the newer, 50.4 per cent. of the older immigrants were without occupation (principally women and children) while only 25 per cent. of the new element is composed of this class. The older immigration suffers, consequently, in a comparison because of the presence of these women and children.

Are the conclusions altered by eliminating those immigrants who have no occupations? First, let us examine the statistics for the "old" immigration.

The following table gives the occupational distribution of the immigrants from the countries of Northwestern Europe during the years 1871–1882.

TABLE IV.

IMMIGRANTS WITH OCCUPATIONS FROM NORTHWESTERN EUROPE (INCLUDING CANADIANS) FOR THE PERIOD 1871–1882, INCLUSIVE, CLASSIFIED BY COUNTRY AND OCCUPATIONS.

Country	Professional		Skilled Laborers		Farmers and Farm Laborers		Common Laborers		Servants		Miscellaneous Occupations		Occupations Not Stated		Total with Occupations	
	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.	Number	Per Cent.
1. Great Britain	8,305	2.4	118,338	34.3	31,083	9.0	134,372	39.0	24,271	7.0	24,353	7.1	4,186	1.2	344,908	100.0
2. Ireland	2,416	0.8	32,062	10.0	16,642	5.2	193,325	60.5	66,667	20.9	5,322	1.6	3,145	1.0	319,579	100.0
3. Germany*	9,743	2.0	132,057	26.5	128,553	25.7	167,295	33.5	14,087	2.8	36,245	7.3	11,186	2.2	499,166	100.0
4. Austria†	668	1.5	8,104	18.6	7,190	16.5	22,614	51.8	836	1.9	3,566	8.0	748	1.7	43,681	100.0
5. Scandinavian Countries‡	1,480	0.7	35,027	15.6	51,152	22.7	116,518	51.8	15,382	6.8	2,670	1.2	2,603	1.2	224,832	100.0
6. France	3,978	7.5	18,297	34.4	5,887	11.1	12,937	24.3	2,718	5.1	7,896	14.7	1,438	2.9	53,151	100.0
7. Switzerland	745	2.8	9,206	34.7	9,005	34.0	4,007	15.1	989	3.7	2,364	8.9	205	0.8	26,521	100.0
8. Canada§	3,164	0.9	67,636	20.9	123,474	38.1	63,856	19.7	18,637	5.8	11,582	3.6	35,326	10.9	323,675	100.0
Total	30,515	1.7	420,822	22.9	372,986	20.4	714,924	38.9	143,587	7.8	93,938	5.1	58,832	3.2	1,835,508	100.0

* These figures include Austrian immigration for the years 1871 and 1872.
† These figures are only for the period 1873–1882, inclusive.
‡ This group includes Norway, Sweden, and Denmark.
§ Canada includes Quebec, Ontario, Nova Scotia, New Brunswick, Prince Edward's Island, Newfoundland, Labrador and Vancouver's Island.

Under this new basis the skilled workers comprise 22.9 per cent. of the total instead of 11.4 per cent., as before. The relative distribution of occupations in the different national groups is especially noteworthy; 36.7 per cent. of the English, 41.9 per cent. of the French, 37.5 per cent. of the Swiss, and 28.5 per cent. of the Germans were either professional or skilled workers, while only 10.8 per cent. of the Irish, 16.3 per cent. of the Scandinavians, and 21.8 per cent. of the Canadians belonged to these classes. On the other hand 81.2 per cent. of the Irish were either laborers or servants, as were 58.6 per cent. of the Scandinavians, while only 46 per cent. of the English belonged to these classes, 36.3 per cent. of the Germans, 29.4 per cent. of the French, and 18.8 per cent. of the Swiss.

The next table gives similar figures for the immigration from Southeastern Europe for the later period.

TABLE V.

IMMIGRANTS WITH OCCUPATIONS FROM SOUTHEASTERN EUROPE (INCLUDING SYRIANS) FOR THE PERIOD 1899–1909, INCLUSIVE, CLASSIFIED BY OCCUPATIONS.

(Compiled from Report of the United States Immigration Commission, 1911, Volume I, page 174.)

Occupation	Number	Per Cent.
Professional	28,916	0.5
Skilled laborers	804,920	18.1
Farm laborers	1,151,697	25.8
Farmers	45,518	1.0
Common laborers	1,880,491	42.2
Servants	465,395	10.5
Miscellaneous	82,548	1.9
Total with occupations	4,452,475	100.0

A comparison of Tables IV and V shows that 1.7 per cent. of the total number of immigrants with occupation from countries representative of the old immigration were professional, whereas only 0.5 per cent. of the new immigrants were of this class. Skilled workers comprised 22.9 per cent. of the immigrants from the countries from Northwestern Europe; 18.1 per cent. of those from Southeastern. Here the difference, though real, is not decisive. Two-ninths of the earlier immigrants with occupations from the countries which we believe to be ethnically and industrially similar to ours were skilled; two-elevenths of those that we regard as absolutely alien to us are skilled.

IV.

CONCLUSION.

The figures given by Jenks and Lauck showing that the "new immigration" is less than half as skilled as the "old" are fallacious, owing to the fact that they cover the same years. The statistics given in this article comparing the years 1871–1882 with 1899–1909 afford a truer criterion for comparison. Comparing the total immigration from Northwestern Europe during the earlier period with that from Southeastern Europe during the later, we find that the older immigration had only 11.4 per cent. of its numbers skilled workers, while the newer immigration has 16.6 per cent. On this basis of comparison, therefore, the newer immigration has proportionately 50 per cent. more skilled workers than had the earlier.

If we compare these two migrations solely in relation to the number of immigrants with occupations, the conclusions are somewhat changed; 18.1 per cent. of the recent immigrants from Southeastern Europe are skilled, whereas 22.9 per cent. of the older set were skilled. Using this base, the workers of the new immigration are relatively eight-tenths as skilled as those of the old, instead of less than one-half, as the figures of Jenks and Lauck would lead us to suppose. It must furthermore be emphasized that Jenks and Lauck compared the total immigration, irrespective of whether the immigrants had occupations or not; the employment of this method led to the results given in the previous paragraph, namely that the new immigration is 50 per cent. more skilled than the old.

It is an open question whether the total immigration or the total with occupations should be the proper basis for comparison. Certainly the first does not give a true picture, since it includes children; the second is deficient, however, in that it does not include many women who later enter American industrial life as unskilled workers. Neither one can be selected as the sole basis for judgment. Considering that since the first base shows the newer immigration to include relatively more skilled workers than the old immigration, while the latter reverses the situation to a less degree, is it not fair to conclude, in view of the inadequacy of either of these bases as a sole criterion, that skilled craftsmen are now relatively not less important than in the earlier immigration? Is it not accurate to state that the new immigration is approximately as skilled as the old?

We should remember, however, that statistics measure quantitative differences only; they are not a true index of qualitative differences. Though the statistics here produced show that Southeastern Europeans have as many skilled workers relatively as Northwestern Europeans, it does not follow that within this class the workers are as highly developed in their line of work as the men from the corresponding skilled class in Northwestern Europe.

If this long-accepted belief in the higher percentage of skilled workers among the old immigration is, after all, erroneous, why has it been cherished for so long? In the first place because we have not realized that the character of the immigration from Northwestern Europe has changed in the last thirty years. Whereas from 1871 to 1882 only 11.4 per cent. of the total number from this section of Europe were skilled, during the period 1899–1909, 19.5 per cent. of these immigrants were skilled. During the period 1871–1882 the skilled workers comprised 22.9 per cent. of the total with occupations; by 1899–1909 this had risen to 27.8 per cent. Thus the immigration from Northwestern Europe is today more skilled than it was formerly. The unskilled laborers from the Southeast have displaced the unskilled laborers from the Northwest, and have left the latter countries with a more highly skilled emigrant constituency. The Immigration Commission and Jenks and Lauck came to their conclusion because they neglected this change in the immigration from Northwestern Europe.

Secondly, in speaking of the old immigration we commonly think of the English, the Welsh, the Scotch, the French, and the Germans, all highly skilled populations; we forget the Irish, the Danish, the Norwegians, and the Swedish, essentially agrarian and not industrial peoples. As was shown, only 10 per cent. of the Irish immigrants with occupations during this early period were skilled, and only 15.6 per cent.

of the Scandinavians. This is greatly below the percentage of skilled craftsmen in the new immigration.

Finally, it is the custom of each generation to view the immigrants of its day as inferior to the stock that once came over. Some of this prejudice against the newer races has not been wholly absent from some of the writings upon American immigration problems.

NOTICE.

Report on the seventy-fifth anniversary funds of the American Statistical Association, including income and expenditure for the Memorial Volume, "History of Statistics," 1913 to December, 1918, as required by resolutions of the Association passed at the Annual Meeting, 1918:

INCOME.

Contributions by members to the 75th Anniversary Fund with interest on same, 1913–1916	$1,097.16	
Sales of 175 Volumes to Members, 1918	672.31	
Receipts from sales by Macmillan, 1918	244.16	
Loan to meet deficit	1,500.00	
Total		$3,513.63

EXPENDITURES.

Anniversary Dinner, Boston, 1914	$287.40	
Preparation of Volume, 1914–1918 (exclusive of press work)	702.60	
Printing of Volume, 1918, (Rumford Press)	2,200.00	
Total		3,190.00
Balance owed Rumford Press Dec., 1918 (This balance has been paid since Dec., 1918.)	527.75	

To meet the deficit indicated above the Association authorized the Board to borrow $1,500.00, giving as security Boston and Albany R. R. stock, 17 shares, owned by the Association. This was done by the Treasurer and the loan is still outstanding

ROB'T E. CHADDOCK,
Secy.-Treas.

REVIEWS AND NOTES.

Cost Accounting, by J. Lee Nicholson, C. P. A., and John F. D. Rohrbach, C. P. A. New York: The Ronald Press, 1919. 576 pp.

The readers of the QUARTERLY who are engaged in the increasingly important task of applying the statistical method to the internal records of large corporations will find this book on cost accounting of great assistance. The work of statisticians connected with manufacturing or selling organizations involves not only the handling of summary figures that are furnished them ready-made but also the critical examination of the methods of collecting and assembling these figures. Those, therefore, who are interested in the technique of business measurement will want to use this volume.

Although the reader will not come upon references to theoretical statistics, he will, as he turns the pages, find many places in which cost accounting enables him to apply to business the familiar devices of the trained statistician, such as frequency studies, correlation, means, medians and modes. The chapter on estimated costs suggests the opportunity for applying the method of sampling, and computing percentages of error. It is interesting also to note that in two places the authors make favorable reference to the use of graphic representation of cost data for the purpose of executive control.

The book is an extention of Nicholson's "Cost Accounting, Theory and Practice," published in 1913. As stated in the preface, one of the important aims of the book is to "classify the details of cost accounting so that the reader, be he accountant, manufacturer, or student, is given a well-defined idea of the forms and records required for each separate operation." The book is complete and comprehensive without undue length. The writer of this review has discussed the merits of the book with expert accountants both in the East and the Middle West and found the opinion unanimous that it covers the ground clearly and fully. The present edition contains additional valuable matter concerning depreciation rates. The subject of depreciation is well treated. In view of the wide-spread interest in cost-plus contracts, and the making and suspending or cancelling of contracts with the government, the discussion of these subjects is very important just at this time.

One of the authors was chairman of the Interdepartmental Conference on Uniform Contracts, and Cost Accounting Definitions. This conference consisted of delegates from the Departments of War, Navy, Commerce and other government bodies. The purpose of the conference was expressed by its name.

Uniform cost methods—or as the authors prefer to say—uniform methods of cost finding come in for considerable emphasis. To quote directly:

"Their main object and chief advantage of their use is that all costs may be figured in precisely the same way. Any mistakes made in determining the selling price would then be the same throughout that particular trade, in which event, unfair and ignorant competition would cease, despite the faults or deficiencies in the methods of cost finding adopted."

The manner in which the authors have handled their subject commands attention. They are careful not only to define their own terms but to present the definitions of similar terms used by others. This will be appreciated by those who have had to follow cost analyses. In matters on which there is a variety of opinion they have explained all contentions, for example, whether or not interest on capital invested should be regarded as an element of cost. At the same time they have not been afraid to state their own opinion and the reasons for it. Where it is possible to follow several different methods, the advantage of one method over another under certain circumstances is clearly stated, as for example the various methods of prorating factory overhead charges.

The entire work is a happy combination of theory and practical example. The writer found that the book is being used as a handbook in a number of organizations where cost systems were being installed or improved. The forms are illustrated and can be followed in actual practice. The chapter on the examination of the plant preparatory to the installation of a cost system contains a very valuable checking list which should furnish statisticians with a wealth of suggestions for the analysis of business.

Good English, clear type, and splendid arrangement of text make the book pleasing and attractive. An analytical table of contents covering fourteen pages, and a detailed index furnish means of quick reference. Concise and comprehensive summaries at the end of nearly every chapter enable the reader to review the subject matter and to fix in mind the points emphasized.

Arthur R. Burnet.

Housing Standards in Brooklyn. By John C. Gebhart. Published by the Tenement House Committee of the Brooklyn Bureau of Charities, October, 1918. Pp. 60.

This report, dealing with the housing of 3,227 Brooklyn families, is based on information obtained through the Relief Department and the District Nursing Committee of the Brooklyn Bureau of Charities, the Jewish Aid Society, and the Tuberculosis Day Camp. The study, therefore, has to do with families which are either dependent or under the care of a philanthropic agency by reason of illness. Statistics are presented and discussed under the following main heads: Sanitation, interior rooms, room overcrowding, lodgers, land overcrowding, type of dwelling, tuberculosis, rents, and nationalities..

In purpose and scope the report is a description of the conditions affecting a given group of families, rather than an attempt to trace causes and effects

(p. 58). An exception is the finding, tentatively stated, that the presence of tuberculosis is more closely related to room overcrowding than to faulty sanitation.

While the analysis is, in general, cautious and sound, the statistical reasoning is open to question at certain points. Thus, the author appears to assume that the number of families per dwelling, without reference to the size of the dwelling, is a trustworthy index of land overcrowding. Again, as the report emphasizes the effect of economic status upon housing, the comparison of room crowding in this group of mainly dependent families with Rowntree's data for the entire working population of the city of York, England, appears lacking in point. The reviewer is not convinced by reasoning to the effect that, because 50 per cent of the families paid rentals of from $10 to $15 per month, and "since the item of rent has been found to consume from 25 to 30 per cent of the family income of the working population," therefore "it is fair to assume that the average family studied has an income of about $50 a month or $600 a year" (pp. 40 and 54).

A feature of the report which will be regretted by statisticians is the absence of an adequate statement as to the manner and method of the inquiry. When was the study made? Was a schedule used and, if so, what did it include? What is the relation, numerical and otherwise, of the group of families studied to the whole number of dependent families in Brooklyn? The report does not answer these questions.

In view of change in prices, wages, and opportunities for employment that has occurred within the past few years it seems important to know whether or not the data for all the families relate to the same period of time. The statement (p. 47) that reports as to nationality in some instances were "based on personal impression rather than scientific inquiry," raises a question as to the methods by which the facts were collected.

In discussing the sufficiency of the number of cases studied, the author compares the families for which information was secured with the total population of Brooklyn. The purpose of this comparison is not clear. The author is dealing with families coming under the care of philanthropic agencies; hence the number of families considered should be related to the entire number of families which have found it necessary to apply to such agencies for assistance.

The preceding paragraphs have been written from the standpoint of the statistician concerned with methods of social research. In judging the results of the study it should be said that the statistics are, in general, stated and analyzed in a way that implies a painstaking and thorough inquiry. The author's findings regarding the housing of the dependent poor in Brooklyn will be of value to social workers seeking to improve these conditions and will provide investigators in other cities with material for significant comparisons.

EARLE CLARK.

ANNUAL CENSUS OF THE INSANE AND FEEBLE-MINDED, EPILEPTICS AND INEBRIATES IN INSTITUTIONS IN THE UNITED STATES JANUARY 1, 1918.

(Published in *Mental Hygiene* for January, 1919.)

This is the second annual census of the defective classes published under the auspices of the National Committee for Mental Hygiene and prepared by Horatio M. Pollock, statistician of the New York State Hospital Commission and Edith M. Furbush, statistician of the National Committee for Mental Hygiene.

The study is based on reports from 575 institutions, of which 346 were public and 229 private. No attempt was made to secure data from almshouses, penal or reformatory institutions.

On January 1, 1918, there were 239,820 insane patients under treatment in institutions in the United States. Compared with the census of 1917, taken under the same auspices, the number shows a total increase of 6,947 patients. The sex distribution of the insane under treatment varies widely in the several states; but the relative proportion of the sexes has shifted but little. The ratio shown by the present census is 110.55 males to 100 females. The women outnumber the men in some of the eastern and southern states, while the men are greatly in excess in most of the western states.

There is a steady upward trend in the ratio of insane in institutions to the general population. In most of the states where the increase of the insane in institutions has been most marked it is unquestionably due to enlarged provisions for their care. In short, the high rates of insanity in the different states do not necessarily indicate a greater prevalence of mental disease but rather that a larger proportion of the total number of insane in the community is being cared for.

The census shows a total of 39,381 feeble-minded persons in institutions, an increase of 2,567 as compared with 1917. Institutional care of the feeble-minded is not well developed in several states. In Alabama and Georgia there are no state institutions for the feeble-minded. In Arizona, Arkansas, Delaware, Florida, Idaho, Louisiana, Mississippi, Mew Nexico, Nevada, South Carolina, Tennessee, Utah and West Virginia, the feeble-minded are cared for in state hospitals for the insane. "In no state does the provision for the feeble-minded equal that made for the insane." Indeed, it is borne out by the statistics that private institutional care of the feeble-minded is relatively farther advanced than public institutional care.

It is a hopeful sign that many state institutions for feeble-minded have recently been established. During 1917 and 1918, five states authorized the establishment of institutions for feeble-minded and in seven others additional institutional facilities were provided for this class.

Epileptics to the number of 11,944 were found in institutions on January 1, 1918. As is well known, only a small proportion of the total number of epileptics is cared for in institutions of any kind.

There were 3,565 inebriates under institutional care, and by far the largest proportion in public institutions. For the census year, the inebriates in institutions showed a total decrease of 1,326, or 37.2 percent. "The figures give conclusive proof that inebriety is a decreasing rather than a growing evil in this country." In speaking of the wide variations in the number of inebriates cared for in the several states, the authors say that it "is partly due to the lack of institutions for inebriates in some states and partly due to the lack of inebriates in others."

The National Committee for Mental Hygiene performs a genuine service in taking an annual census—even if it be quite summary—of the various defective classes in public and private institutions. The work has been done most carefully and supplements in a desirable manner the too infrequent reports of the Federal Census.

NEW SERIES, No. 127. (VOL. XVI.) SEPTEMBER, 1919.

QUARTERLY PUBLICATIONS OF THE AMERICAN STATISTICAL ASSOCIATION.

I. RETAIL PRICES OF FOOD DURING 1917 AND 1918. By Raymond Pearl and Magdalen H. Burger.

II. AN ATTEMPT AT A STATISTICAL DETERMINATION OF THE BIRTH-RATE IN THE UNITED STATES. By A. N. Kiaer, Ex-Director of the Statistical Bureau of Norway; Honorary Member of the American Statistical Association.

III. SOME CONSIDERATIONS IN VITAL STATISTICS EDUCATION. By Louis I. Dublin and Edwin W. Kopf.

IV. FOOD EXPENDITURES BY MEN AND WOMEN. By Horace Secrist.

V. ON FUNCTIONAL RELATIONS FOR WHICH THE COEFFICIENT OF CORRELATION IS ZERO. By H. L. Rietz.

VI. NEW MEMBERS OF THE ASSOCIATION, ELECTED JANUARY TO JUNE, 1919.

VII. NOMINATING COMMITTEE FOR ANNUAL ELECTION OF OFFICERS, 1919.

VIII. REVIEWS AND NOTES: The Review of Economic Statistics, *Walter F. Willcox;* The War with Germany: A Statistical Summary, *Earle Clark;* Statistics of the Influenza Epidemic; Anent the New and the Old Immigration, *Isaac A. Hourwich.* Resolution of the Casualty Actuarial and Statistical Society of America.

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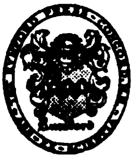

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AMERICAN
STATISTICAL ASSOCIATION

NEW SERIES, No. 127. SEPTEMBER, 1919

RETAIL PRICES OF FOOD DURING 1917 AND 1918.

BY RAYMOND PEARL AND MAGDALEN H. BURGER.

The United States had been technically at war for some months when Congress, in August, 1917, enacted a law "to further provide for the national security and defense by encouraging the production, conserving the supply and controlling the distribution of food products and fuel." Under authority of the act referred to the President created the United States Food Administration and appointed Mr. Herbert Hoover to the supervision and direction of its functions.

The law was comprehensive in its purposes and the functions of the Food Administration in its war-time activities were wide. To safeguard the public interests and insure an efficient administration, the law provided certain regulations restricting many business and commercial practices with which in times of peace the government had not interfered. The President was authorized to license certain kinds of business and to prescribe regulations and practices for systems of accounts and auditing of accounts of licensees; to require the submission of reports by them; the discontinuance of unfair, unjust, discriminating, unreasonable practices, and the entry and inspection of licensees, places of business by authorized agents. Agricultural producers were excepted from the operation of these requirements of the law as were also retailers of products who were not engaged in the wholesale business and whose gross sales did not exceed $100,000 per annum. Severe penalties were provided for the violation of many of these regulations.

Because of the somewhat unique character of the retail price work of the Statistical Division of the Food Administration it seems desirable to make a permanent record of the summarized results of this line of activity. The outstanding difference between the retail price reporting of the Food Administration and ordinary statistics of such prices lay in the fact that the Food Administration's prices were the prices actually paid by actual consumers, and directly reported by them weekly. The data passed through no intermediate hands interested in the trade.

Though not a mandatory requirement of the Act, one of the fundamental purposes of the Food Administration was to do everything possible to regulate and keep the retail prices of staple articles of food at a minimum to the consumer. The law, as already stated, did not apply to the operations of retailers whose annual gross sales were less than $100,000, but it was possible to control their prices in no small degree through the direct control which the Food Administration had over licensees. It was planned to keep a close watch of retail prices with the aid of volunteers from among the consumers themselves, through a scheme of weekly reports from a selected number of reliable people in every town and city of 3,000 or more inhabitants. A supply of blank forms, printed and designed for the purpose of conveniently making reports of the current prices of twenty-eight staple food articles charged in his or her respective community on a fixed day of the week, was sent to each of such volunteer reporters. Pursuant to arrangements made with these consumer-reporters, the blanks, properly filled in with the desired data, were regularly mailed back to the Food Administration each week.

The intention in inaugurating this work was to supplement, for reasons of administrative necessity in the Food Administration, the retail price reports of the Bureau of Labor Statistics, in respect of the following points:

1. Wider area.
2. More comprehensive list of foods.
3. More frequent intervals (weekly instead of monthly).
4. Reports from consumers instead of dealers.

Valuable assistance in obtaining these volunteer reports was initially rendered by the Comptroller of the Currency, who sent out to the banks of the country a circular statement of the plan, accompanied by a request that officials and employees of the banks interest themselves in securing the services of one or more volunteer reporters in their respective communities. Aid in securing reliable reporters was also furnished by other persons and officials, including the Food Administrators in the several states. These methods brought very gratifying results both in the number and character of the reporters.

The duties of the volunteer reporters were to visit personally representative grocery stores in their vicinity and obtain the retail prices at which these stores were selling the selected food staples each week. The prices thus ascertained were carefully entered on the forms supplied and then regularly and promptly mailed to the Food Administration. In the majority of cases the prices reported were those taken by the reporter from her own sales slips of goods she had actually purchased.

Promptly after the first week's reports had been received from the reporters in October, 1917, the "Retail Prices" Section of the Statistical Division began the work of assembling the data and tabulating the results. With equal promptitude it prepared a weekly bulletin setting forth these results, accompanied by a study of them. This became the routine work of the section, which grew in volume with the number of reporters and the amplification of the detailed data furnished by them.

The Canadian Food Administration had established a similar retail price collecting service and sometime after the establishment of our service an arrangement was entered into with the Canadian Administration for an exchange of reports. Thereafter the prices reported in the Canadian provinces were included in our weekly and periodical reports. The Canadian price figures, when differently reported, were reduced to the equivalent of prices in our units. Later the work of the section was increased by the preparation of monthly and quarterly reports, in addition to which special reports were from time to time prepared to serve the needs of other governmental officials or bureaus.

From a few clerks and stenographers, the clerical organization engaged in the collection, assembling, and tabulation of the data pertaining to retail prices, grew and expanded until at the time when the work was discontinued the personnel of this branch consisted of about thirty-five people. Its work was constant and often exacting, but the *esprit de corps*, loyalty and enthusiasm of the employees of this branch was probably not excelled by that of any other assemblage of war workers which the emergency drew together in Washington.

For reasons which, in the judgment of the Food Administration, rendered it improper or inexpedient to give full publicity to the retail price data, only limited dissemination of them was made. This was done through the issuance of the regular weekly mimeographed bulletin or through the quarterly and other occasional bulletins. The distribution of these bulletins was never extended to others than heads of the Food Administration in Washington and the State Food Administrators.

Though this division of the Food Administration constantly dealt with specific and definite data and its reports were always expressed in dollars and cents, it is obvious that the results on control of retail prices to the consumer cannot be thus definitely expressed or shown. To those who have had to do with these things, however, either in Washington or in the several states, it is well known that the work of the Food Administration along these lines was highly beneficial and effective in limiting the exaction of excessive prices by the local retailer. Had the Food Administration been invested with wider and more far reaching powers it would have probably been practicable at all times to keep retail prices within reasonable limits. There is abundant testimony in the files of the Food Administration to support this assertion.

The first weekly reports received were for the week of October 6, 1917, when reports were received from 839 reporters representing 798 towns and cities. On September 28, 1918, which marked the close of a year of fifty-two weeks, the work had so increased that reports were received from 1,871 reporters representing 1,305 towns and cities.

The number of reports received, and the number of different cities and towns from which they came are exhibited, for each week during the continuance of the service, in Table A.

TABLE A.

STATEMENT SHOWING NUMBER OF REPORTS RECEIVED AND CITIES AND TOWNS REPRESENTED IN SUCH REPORTS, FOR EACH WEEK FROM OCTOBER 6, 1917 TO DECEMBER 28, 1918.

Week ending	Number of reports	Number of cities and towns	Week ending	Number of reports	Number of cities and towns
1917			1918		
Oct. 6	839	798	May 4	1,795	1,283
13	1,003	815	11	1,881	1,328
20	1,033	826	18	1,948	1,330
27	1,071	805	25	1,918	1,292
Nov. 3	1,029	801	June 1	1,900	1,350
10	1,076	844	8	2,076	1,376
17	1,096	841	15	1,936	1,313
24	1,238	837	22	2,037	1,365
Dec. 1	1,226	904	29	2,103	1,429
8	1,324	990	July 6	2,023	1,386
15	1,479	1,116	13	2,017	1,386
22	1,324	1,027	20	2,012	1,395
29	1,351	1,082	27	2,026	1,387
1918					
Jan. 5	1,461	1,146	Aug. 3	2,021	1,393
12	1,681	1,238	10	1,993	1,369
19	1,746	1,286	17	1,957	1,328
26	1,913	1,412	24	1,957	1,336
Feb. 2	1,871	1,376	31	1,859	1,312
9	1,894	1,373	Sept. 7	1,924	1,353
16	1,875	1,345	14	1,855	1,332
23	1,873	1,394	21	1,859	1,308
Mar. 2	1,836	1,350	28	1,871	1,305
9	1,833	1,338	Oct. 5	1,906	1,405
16	1,846	1,360	12	1,842	1,299
23	1,859	1,431	19	1,857	1,303
30	1,943	1,420	26	1,879	1,325
Apr. 6	1,907	1,357	Nov. 2	1,803	1,273
13	1,915	1,371	9	1,686	1,205
20	1,846	1,291	16	1,604	1,155
27	1,740	1,341	23	1,710	1,124
			30	1,710	1,229
			Dec. 7	1,773	1,293
			14	1,744	1,256
			21	1,463	1,021
			28	1,400	1,030

The utmost pains were taken to ensure the accuracy of the individual reports. Whenever the price returned for a particular article seemed too high or too low, in comparison with other reports from the same or nearby localities, the report was returned for correction or verification and explanation. By this system it is believed that the finally accepted reports had a high degree of accuracy.

The Canadian prices represent reports from fifty-eight cities. Comparison with Canadian prices is impracticable on all articles for which prices are quoted in the United States, either because no prices were quoted by Canada on certain commodities, or if quoted, were quoted on unit bases not readily reduced to the United States unit.

Canada potato prices are omitted because the seasonal production of potatoes in Canada varies so greatly from that in many parts of the United States that it is impracticable to make reliable comparisons.

This report presents statistics for the selected commodities as follows:

Table I—Analysis, by states, of the *highest* and *lowest* average retail prices on 15 of the principal food staples, showing the states quoting *highest* and *lowest* prices the greatest number of weeks, together with the average prices in the United States.

Table II—A comparison for the week ending October 6, 1917, with the week ending September 28, 1918, of average prices on 28 staple foods in the United States and on 22 in Canada, showing also the absolute and percentage increases and decreases in such prices for the year.

Table III—Quarterly averages of prices, together with the yearly averages, for the period beginning with the week ending October 6, 1917, and ending September 28; 1918, on 28 staple food articles in the United States.

Table IV—Statement showing average retail prices on 28 staple food articles in the United States for each month, from October, 1917, to September, 1918, together with the aggregate prices and monthly percentage increases or decreases on all articles combined.

Table V—Statement showing average retail prices for each week from October 6, 1917, to September 28, 1918, on 28 staple food articles in the United States and on 22 in Canada.

Table VI—Statement showing average and relative weekly prices in the United States on 8 selected commodities, beginning with the week ending October 6, 1917, and ending September 28, 1918. (The base period equals the average of October prices taken as 100.)

Table VII—Statement showing average retail prices for each week from October 5, 1918, to December 28, 1918, on 28 staple food articles in the United States and on 22 in Canada.

Analysis by States of the Highest and Lowest Prices on Fifteen of the Principal Food Staples (Table I).

The highest quotation during the year for a 1-16 bbl. bag of wheat flour was reported by Connecticut, at 95 cents, and the lowest price by Utah, at 64.7 cents. Wheat flour was highest in Florida 21 of the 52 weeks in the year; and lowest in Utah, 32 weeks. The price of a pound loaf of bread was highest in Montana and Nevada, 18 weeks each; and lowest in the District of Columbia, 23 weeks. Cornmeal was highest in Nevada for 34 weeks and lowest in Alabama and Tennessee 25 and 26 weeks, respectively.

The compilation of states reporting highest and lowest meat prices the greatest number of weeks during the year, shows that Nevada reported the highest price on bacon, 21 weeks; Massachusetts and Rhode Island on round steak, 20 and 31 weeks, respectively; and Arizona and the District of Columbia, 13 and 24 weeks, respectively, on pork chops. During the yearly period, Wisconsin and New Hampshire reported the lowest bacon prices, 14 and 21 weeks, respectively; Oregon was lowest on round steak, 44 weeks; and Wisconsin lowest on pork chops, 29 weeks.

Milk has been consistently highest in the southern states, Alabama reporting the highest price for the year, and South Carolina the highest average weekly price the greatest number of times. Wisconsin and South Dakota showed lowest prices 19 and 23 weeks, respectively. Of the other dairy products, butter was highest in Nevada, 15 weeks; cheese in New Mexico, 23 weeks; and eggs in Connecticut, 21 weeks.

Butter was lowest in North Dakota, 34 weeks; cheese in Wisconsin, 15 weeks; and eggs in South Dakota, 21 weeks. The highest price for oleomargarine was quoted from Wyoming, and the lowest from Texas.

West Virginia reported the highest sugar quotations for 10 weeks and Nevada for 20 weeks; lowest sugar prices were reported in the District of Columbia and California, 21 weeks each.

Potatoes were also uniformly highest in the South and lowest in the Western Mountain states. Georgia and South Carolina reported the highest prices the greatest number of times; and Utah and Idaho, the lowest.

An outstanding fact in Table I, is that Nevada quoted highest prices of the year on four commodities: bacon, butter, cheese and rice; and is one of the states quoting the highest price 10 or more weeks on the following commodities: on wheat bread, 18 times; cornmeal, 34 times; sugar, 20 times; bacon, 21 times; lard, 18 times; butter, 15 times; oleomargarine, 10 times; cheese, 10 times; and on rice, 13 times.

Summary of Changes in Retail Prices for the Year (Table II).

During the yearly period from the week ending October 6, 1917, to September 28, 1918, 22 commodities increased and 6 decreased in the United States. In Canada, during the same period, 19 commodities increased and 3 decreased. With the exception of milk and fish, all of the comparable commodities which increased in the United States also increased in Canada. The rate of increase was greater in Canada than in the United States upon all of these commodities, except the following five which were greater in the United States: butter, by 15 per cent.; steak, by 9.6 per cent.; cheese, by 4 per cent.; eggs, by 1.9 per cent.; and bacon, by 1.3 per cent. Noticeable percentage increases in the United States were indicated on potatoes, 36.5; on round steak, 30.9; on sliced ham, 28.2; on rice, 24.8; on hens, 24.4; and on butter, 21.1. Increases of over 10 per cent. were also noted on bacon, pork chops, milk, oleomargarine, canned salmon and fresh fish; and of less than 10 per cent. on lard, eggs, cheese, the canned vegetables, onions, sugar, tea and prunes. The decreases were on wheat flour, wheat bread, cornmeal, oatmeal, beans and coffee. The greatest percentage increase in Canada was on rice, 31.5. Large percentages of increase were also shown on canned corn, 29.6; peas, 26.3; salmon, 25; tomatoes, 20.6; tea, 23.5; oatmeal, 23.1; steak, 21.3; pork chops, 18.8; and bacon, 18.6. Increases of more than 10 per cent. were noted on lard, prunes, sugar and coffee. Increases of less than 10 per cent. were on bread, butter, cheese, eggs, and beans. Wheat flour, milk and fish decreased in price.

In the United States the price per 1-16 bbl. bag of wheat flour (Table II) decreased 3.2 cents during the year, being 86.9 cents, the highest price for the whole year, on October 6, 1917, and 83.7 cents on September 28, 1918. In Canada the price of wheat flour, per 1-16 bbl. bag, decreased 1.9 cents, being 83.4 cents on October 6, and 81.5 cents on September 28.

The decreases noted in the United States were 10.7 per cent. on coffee, 9.2 per cent. on wheat bread, 9.1 per cent. on beans, 5.6 per cent. on bulk oatmeal, 3.7 per cent. on wheat flour, and 2.9 per cent. on cornmeal. The decreases in Canada were on wheat flour, milk and fish; they were all less than 4 per cent.

The aggregate cost of the commodities in the United States, for the unit measures quoted, was $8.01 on October 6, 1917, and $8.90 on September 28, 1918. The combined cost of these foodstuffs increased 89 cents, or 11.1 per cent. in a year in the United States and 75.7 cents or 12.3 per cent. in Canada.

Quarterly Averages for the Year (Table III).

The price quotations in Table III are quarterly averages, obtained by calculating an average of the thirteen weekly averages in each quarter for each commodity. This table also shows percentage changes from quarter to quarter and the aggregates of the twenty-eight commodities for each quarter.

Of the cereals and cereal products, wheat flour quotations were highest in the first and last quarters of the year; wheat bread prices decreased in each quarter; cornmeal showed the same average in the first three quarters and decreased slightly in the last quarter; oatmeal fluctuated in price, being slightly less in the fourth quarter than in the first; and rice increased steadily in each quarter.

With the exception of pork chops, which decreased in the second quarter, each quarter showed an increase over the previous quarter in all of the meats listed, the greatest percentage increases being in the last quarter over the third, except for round steak which increased 16.7 per cent. in the third and 8.3 per cent. in the fourth quarter. In the last quarter bacon increased 5.6; ham, 9.5; and pork chops 10.1 per cent.

The average price of milk increased slightly in each quarter, except the third; butter prices increased, except in the third quarter, which showed a decline attributable to seasonal influence; average retail prices of eggs fluctuated, but wholly by reason of seasonal supply and demand; the prices of oleomargarine indicate a similar trend to butter.

Sugar decreased in the second and third quarters and increased in the fourth.

The canned goods all show slight increases in the last quarter over the first, but canned salmon shows an increase in each quarter, the greatest being in the fourth quarter.

The aggregate of the twenty-eight foodstuffs shows increases for each quarter except the third. The decrease in the third quarter, April 6 to June 29, is due mainly to the seasonal decline in the dairy products.

Monthly Averages for the Year (Table IV).

Table IV gives prices of 28 staple food articles, month by month, from October, 1917, to September, 1918. The monthly price is made up of four or five weekly prices, the deciding factor as to the month in which a certain week's price belongs being the majority of that week's days in the month.

The aggregate cost of the twenty-eight commodities was highest for the month of September, 1918, at $8.787 and lowest for the month of April at $7.985. The greatest percentage of increase in price is shown in July and the greatest percentage of decrease in March. Only in three months are decreases shown in comparison with the preceding months—February, March and April.

Between October, 1917, and September, 1918, 21 commodities show increases and 7 decreases. The greatest percentage increases are on the following: Potatoes, 32.5; round steak, 30; ham, 24.3; hens, 23.6; rice, 22.7; bacon, 15.3; and pork chops, 14.1. The prices which were lower in September, 1918, than in October, 1917, were wheat flour, wheat bread, cornmeal, oatmeal, navy beans, prunes, and coffee. The total increase in the month of September, 1918, over the month of October, 1917, in the combined cost of these commodities was 71.3 cents or 8.8 per cent.

Summary of Changes in Retail Prices for the Year, Considered Week by Week (Tables V and VI).

Examination of Table V reveals the fact that in the United States no article shows a continuous rise or fall during the entire period. Sugar declined more steadily, week by week, until the last quarter, and rice increased more steadily than any other commodity.

Of the eight articles for which relative prices are given in Table VI, all show increases except cornmeal. A general downward trend until February 16 is shown in the price of wheat flour, the highest relative figure being 102.5 on October 6 and the lowest 96 on February 9 and 16. For 8 weeks, beginning April 13, the relative figure remained the same, 97.2, and from then most weeks showed an increase until the end of the term. Cornmeal figures were very steady for the entire period. For 18 weeks of the time reported, the relative figure remained 100. In only one week of the year did this commodity vary more than one mill or differ more than 2 mills in any one week from the average for the year. Rice exhibited an almost steady increase from the lowest relative price of 99.1 on October 6 and 13, to the highest relative price of 123.6 on September 21 and 28. From October 27 until July there was a decline in the price of potatoes. A marked increase in price is noted the first week in July, when new potatoes were quoted, as they formed the bulk of the sales. Part B, of Table VI, shows prices for round steak, bacon, pork chops and lard. The meats fluctuated somewhat during the first two quarters and steadily increased the latter two quarters. The ratio of increase was greatest on round steak, the relative price being 99.3 on October 6 and 130 on September 28, an increase of 31 per cent. The next largest meat increase was on bacon, from 97.9 on October 6 to a relative price of 117.4 on September 28, or 20 per cent. Pork chops increased 17 per cent. and lard 9 per cent.

Quarterly Report on Retail Prices for Each Week from October 9 to December 28, 1918 (Table VII).

Table VII is a compilation of average retail prices for each week of the quarter, beginning with the week ending October 5, and ending December 28, 1918, and covers the last three months of weekly reports on retail prices. The figures are not included in the report for the year, which is covered by Table V.

The number of reporters quoting prices for the United States on December 28, was 1,400 and represented 1,030 cities. The comparison of Canadian food prices with those of the United States was discontinued on December 14, as, from that date, the Canadian prices were not forwarded weekly to the Food Administration.

During this period from October 9 to December 28, prices declined in the United States on 11 of the articles listed, increased on 17, and remained the same on 1. The articles which decreased in price were wheat flour, cornmeal, oatmeal, steak, pork chops, lard, potatoes, beans, onions and hens. The increases were shown on rice, bacon, ham, milk, butter, oleomargarine, cheese, eggs, sugar, prunes, canned tomatoes, peas, corn, salmon, fish, tea and coffee. Wheat bread was the same price on October 6 and December 28.

Conclusion.

The purpose of this paper is solely to put on record data which may be useful to the future economic historian who wishes to study the course of retail food prices in the United States during our participation in the Great War. The time has probably not come yet for the writing of such a history. In any event the present authors are not economists and have no intention of invading a field so beset with pitfalls for the unwary. What is here presented is simply a record of a certain group of facts, believed to be substantially accurate. A careful study of them will show in many striking ways the almost immediate effect of regulations promulgated by the Food Administration.

TABLE I.

STATEMENT SHOWING ON 15 SELECTED COMMODITIES FOR THE YEAR, FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, THE *HIGHEST* AND *LOWEST* AVERAGE RETAIL PRICES AND THE STATES REPORTING SAME, THE STATES QUOTING *HIGHEST* AND *LOWEST* AVERAGE PRICES THE GREATEST NUMBER OF TIMES, TOGETHER WITH THE AVERAGE PRICES FOR THE UNITED STATES.

Commodities	General average retail prices for the year in the United States	*Highest* State Average Price				*Lowest* State Average Price			
		For any one week		Quoted greatest number of times		For any one week		Quoted greatest number of times	
		State	Price	State	Number of times	State	Price	State	Number of times
Wheat flour......(1/16 bbl. bag)	$.831	Connecticut.....	$.950	Mississippi...... Florida..........	11 21	Utah..........	$.647	Idaho.......... Utah..........	22 32
Wheat bread..............(lb.)	.102	Arizona......... No. Dakota.....	.150	Montana........ Nevada.........	18 18	District of Columbia....	.070	District of Columbia....	23
Cornmeal, bulk............(lb.)	.067	Louisiana........	.113	Montana........ Nevada.........	9 34	Tennessee.....	.045	Georgia....... Alabama...... Tennessee.....	9 25 26
Steak, round..............(lb.)	.329	Rhode Island....	.537	Massachusetts... Rhode Island....	20 31	Oregon........	.215	Oregon	44
Bacon, sliced..............(lb.)	.498	Nevada.........	.637	Arizona......... Nevada.........	9 21	Florida.......	.395	Wisconsin..... New Hampshire	14 21
Pork chops................(lb.)	.363	District of Columbia.....	.550	Arizona......... District of Columbia.....	13 24	Florida.......	.281	Wisconsin.....	29
Lard.....................(lb.)	.329	New Mexico.....	.400	Nevada.........	18	Oklahoma.....	.283	New Mexico...	9
Milk.....................(qt.)	.126	Alabama........	.180	Florida......... So. Carolina.....	15 18	Utah..........	.088	Wisconsin..... So. Dakota....	19 23

TABLE I—(*Continued*).

STATEMENT SHOWING ON 15 SELECTED COMMODITIES FOR THE YEAR, FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, THE *HIGHEST* AND *LOWEST* AVERAGE RETAIL PRICES AND THE STATES REPORTING SAME, THE STATES QUOTING *HIGHEST* AND *LOWEST* AVERAGE PRICES THE GREATEST NUMBER OF TIMES, TOGETHER WITH THE AVERAGE PRICES FOR THE UNITED STATES.

Commodities	General average retail prices for the year in the United States	*Highest* State Average Price				*Lowest* State Average Price			
		For any one week		Quoted greatest number of times		For any one week		Quoted greatest number of times	
		State	Price	State	Number of times	State	Price	State	Number of times
Butter....................(lb.)	$.526	Nevada.........	$.703	Arizona......... West Virginia ... Nevada.........	11 13 15	No. Dakota ...	$.382	No. Dakota ...	34
Oleomargarine.............(lb.)	.352	Wyoming	.475	Nevada......... Oregon .... So. Carolina.....	10 11 11	Texas	.200	Rhode Island.. District of Columbia ...	13 24
Cheese....................(lb.)	.350	Nevada.........	.436	Nevada......... West Virginia ... New Mexico.....	10 14 23	Wisconsin.....	.297	New Hampshire Utah......... Wisconsin.....	10 11 15
Eggs....................(doz.)	.476	Connecticut.....	.838	Massachusetts... Rhode Island.... Connecticut.....	10 20 21	Oklahoma.....	.260	No. Dakota ... So. Dakota....	13 21
Sugar.....................(lb.)	.096	Montana........	.116	West Virginia ... Nevada.........	10 20	Alabama......	.082	District of Columbia ... California.....	21 21
Potatoes..................(pk.)	.453	No. Dakota	.800	Georgia......... So. Carolina.....	13 14	Utah.........	.153	Idaho........	16
Rice......................(lb.)	.120	Nevada.........	.155	West Virginia ... Nevada......... Montana........	9 13 15	West Virginia	.090	Louisiana..... California..... Utah.........	12 14 17

TABLE II.

A COMPARISON OF AVERAGE RETAIL PRICES FOR THE WEEK ENDING OCTOBER 6, 1917, WITH THOSE FOR THE WEEK ENDING SEPTEMBER 28, 1918, ON 28 STAPLE FOODS IN THE UNITED STATES AND ON 22 IN CANADA, TOGETHER WITH THE INCREASES AND DECREASES FOR THE YEAR.

Commodities	United States				Canada			
	Week ending		Increases (+) or decreases (−)		Week ending		Increases (+) or decreases (−)	
	Oct. 6 1917	Sept. 28, 1918	Absolute	Per cent	Oct. 6 1917	Sept. 28, 1918	Absolute	Per cent
Wheat flour (1/16 bbl. bag)	$.869	$.837	$−.032	−3.7	$.834	$.815	$−.019	−2.3
Wheat bread...(lb.)	.109	.099	−.010	−9.2	.072	.079	+.007	+9.7
Cornmeal, bulk..(lb.)	.068	.066	−.002	−2.9	*	*	*	*
Oatmeal, bulk..(lb.)	.089	.084	−.005	−5.6	.065	.080	+.015	+23.1
Rice..........(lb.)	.109	.136	+.027	+24.8	.092	.121	+.029	+31.5
Steak, round...(lb.)	.291	.381	+.090	+30.9	.286	.347	+.061	+21.3
Bacon, sliced...(lb.)	.462	.554	+.092	+19.9	.451	.535	+.084	+18.6
Ham, sliced....(lb.)	.397	.509	+.112	+28.2	*	*	*	*
Pork chops....(lb.)	.368	.430	+.062	+16.8	.355	.398	+.063	+18.8
Lard..........(lb.)	.308	.336	+.028	+9.1	.312	.369	+.057	+18.3
Milk..........(qt.)	.116	.133	+.017	+14.7	.105	.101	−.004	−3.8
Butter........(lb.)	.511	.619	+.108	+21.1	.495	.525	+.030	+6.1
Oleomargarine..(lb.)	.324	.367	+.043	+13.3	*	*	*	*
Cheese........(lb.)	.348	.368	+.020	+5.7	.302	.307	+.005	+1.7
Eggs.........(doz.)	.482	.529	+.047	+9.7	.514	.554	+.040	+7.8
Sugar.........(lb.)	.098	.102	+.004	+4.1	.106	.119	+.013	+12.3
Potatoes......(pk.)	.419	.572	+.153	+36.5	*	*	*	*
Beans, navy...(lb.)	.187	.170	−.017	−9.1	.165	.168	+.003	+1.8
Onions........(lb.)	.049	.053	+.004	+8.2	*	*	*	*
Prunes........(lb.)	.171	.173	+.002	+1.2	.159	.183	+.024	+15.1
Tomatoes...(2 can)	.168	.173	+.005	+3.0	.141	.170	+.029	+20.6
Peas........(2 can)	.175	.187	+.012	+6.9	.160	.202	+.042	+26.3
Corn.......(2 can)	.175	.183	+.008	+4.6	.189	.245	+.056	+29.6
Salmon.....(1 can)	.272	.308	+.036	+13.2	.264	.330	+.066	+25.0
Fish..........(lb.)	.227	.256	+.029	+12.8	.180	.174	−.006	−3.3
Hens..........(lb.)	.279	.347	+.068	+24.4	*	*	*	*
Tea...........(lb.)	.616	.640	+.024	+3.9	.493	.609	+.116	+23.5
Coffee.........(lb.)	.318	.284	−.034	−10.7	.405	.451	+.046	+11.3
Aggregates....	$8.005	$8.896	$+.891	+11.1	$6.125	$6.882	$+.757	+12.3

*Indicates commodities on which comparison of United States and Canadian prices is impracticable.

TABLE III.

YEARLY AND QUARTERLY AVERAGES OF RETAIL PRICES IN THE UNITED STATES, FOR THE YEAR ENDING SEPTEMBER 28, 1918.

Average price for:	Wheat flour 1/16 bbl. bag		Wheat bread lb.		Cornmeal, bulk lb.		Oatmeal, bulk lb.		Rice lb.	
	Absolute	Per* cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The year	$.829		$.102		$.067		$.087		$.120	
The quarters:										
1st. October 6 to December 29, 1917	.836		.106		.068		.088		.111	
2nd. January 5 to March 30, 1918	.821	−1.8	.102	−3.8	.068	.....	.088	.....	.116	+4.5
3rd. April 6 to June 29, 1918	.824	+0.4	.100	−2.0	.068	.....	.090	+2.3	.120	+3.4
4th. July 6 to September 28, 1919	.835	+1.3	.099	−1.0	.066	−2.9	.085	−5.5	.131	+9.2

Average price for:	Steak, round lb.		Bacon, sliced lb.		Ham, sliced lb.		Pork chops lb.		Lard lb.	
	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The year	$.329		$.498		$.437		$.363		$.329	
The quarters:										
1st. October 6 to December 29, 1917	.291		.478		.406		.356		.322	
2nd. January 5 to March 30, 1918	.299	+2.7	.488	+2.1	.417	+2.7	.344	−3.4	33.2	+3.1
3rd. April 6 to June 29, 1918	.349	+16.7	.499	+2.3	.441	+5.7	.358	+4.1	.331	−0.3
4th. July 6 to September 28, 1918	.378	+8.3	.527	+5.6	.483	+9.5	.394	+10.1	.331	.....

Average price for:	Milk qt.		Butter lb.		Oleomargarine lb.		Cheese lb.		Eggs doz.	
	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The year	$.126		$.526		$.352		$.350		$.476	
The quarters:										
1st. October 6 to December 29, 1917	.122		.516		.348		.350		.524	
2nd. January 5 to March 30, 1918	.127	+4.1	.546	+5.8	.355	+2.0	.354	+1.1	.527	+0.6
3rd. April 6 to June 29, 1918	.127	.....	.501	−8.2	.351	−1.1	.345	−2.5	.386	−26.7
4th. July 6 to September 28, 1918	.129	+1.6	.540	+7.8	.355	+1.1	.350	+1.4	.466	−20.7

*Per cent of increase (+) or decrease (−) compared with the preceding quarter.

TABLE III.—(*Continued.*)

YEARLY AND QUARTERLY AVERAGES OF RETAIL PRICES IN THE UNITED STATES, FOR THE YEAR ENDING SEPTEMBER 28, 1918.

Average price for:	Sugar lb.		Potatoes pk.		Beans, navy lb.		Onions lb.		Prunes lb.	
	Absolute	*Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The Year............	$.096		$.453		$.179		$.052		$.169	
The quarters:										
1st. October 6 to December 29, 1917.........	.099		.440		.186		.051		.172	
2nd. January 5 to March 30, 1918..	.096	−3.0	.426	−3.2	.182	−2.1	.052	+2.0	.169	−1.7
3rd. April 6 to June 29, 1918 ...	.093	−3.1	.332	−22.1	.178	−2.2	.050	−3.8	.168	−0.6
4th. July 6 to September 28, 1918.........	.096	+3.2	.580	+74.7	.172	−3.4	.056	+12.0	.168	.....

Average price for:	Canned tomatoes No. 2 can		Canned peas No. 2 can		Canned corn No. 2 can		Canned salmon No. 1 can		Fish, fresh lb.	
	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The year	$.166		$.178		$.173		$.282		$.247	
The quarters:										
1st. October 6 to December 29, 1917	.165		.176		.174		.272		.235	
2nd. January 5 to March 30, 1918..	.163	−1.2	.177	+0.6	.171	−1.7	.274	+0.7	.258	+9.8
3rd. April 6 to June 29, 1918 ...	.165	+1.2	.177	......	.172	+0.6	.281	+2.5	.246	−4.7
4th. July 6 to September 28, 1918	.169	+2.4	.181	+2.3	.177	+2.9	.301	+7.1	.251	+2.0

Average price for:	Hens lb.		Tea lb.		Coffee lb.		AGGREGATES	
	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent	Absolute	Per cent
The year............	$.323		$.626		$.304		$8.239	
The quarters:								
1st. October 6 to December 29, 1917..........	.282		.621		.318		8.113	
2nd. January 5 to March 30, 1918..	.319	+13.1	.626	+0.8	.315	−0.9	8.212	+.012
3rd. April 6 to June 29, 1918 ...	.344	+7.8	.626	......	.300	−4.8	8.022	−.023
4th. July 6 to September 28, 1918	.347	+0.9	.630	+0.6	.284	−5.3	8.581	+.070

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* Per cent of increase (+) or decrease (−) compared with the preceding quarter.

TABLE IV.

A MONTHLY COMPARISON OF AVERAGE RETAIL PRICES IN THE UNITED STATES FOR THE YEARLY PERIOD, OCTOBER 1917 TO SEPTEMBER 1918, INCLUSIVE, ON 28 STAPLE FOOD ARTICLES.

Commodities	Average monthly prices*											
	1917			1918								
	October	November	December	January	February	March	April	May	June	July	August	September
Wheat flour..........(1/16 bbl. bag)	$.848	$.834	$.823	$.821	$.818	$.825	$.823	$.824	$.827	$.831	$.837	$.837
Wheat bread...............(16 oz.)	.108	.107	.103	.103	.102	.102	.100	.100	.100	.099	.099	.099
Cornmeal, bulk................(lb.)	.068	.068	.068	.068	.068	.069	.069	.069	.066	.066	.066	.066
Oatmeal, bulk.................(lb.)	.089	.088	.087	.088	.087	.088	.091	.092	.086	.085	.085	.085
Rice..........................(lb.)	.110	.111	.112	.114	.116	.113	.119	.119	.124	.128	.133	.135
Steak, round..................(lb.)	.293	.289	.289	.294	.299	.304	.323	.350	.375	.376	.376	.381
Bacon, sliced.................(lb.)	.472	.480	.485	.490	.491	.483	.491	.497	.509	.514	.527	.544
Ham, sliced...................(lb.)	.404	.406	.410	.415	.419	.419	.428	.437	.460	.469	.483	.502
Pork chops....................(lb.)	.369	.351	.346	.347	.343	.341	.349	.358	.368	.373	.394	.421
Lard..........................(lb.)	.312	.325	.332	.332	.333	.332	.333	.332	.329	.328	.331	.335
Milk..........................(qt.)	.118	.123	.126	.127	.127	.128	.127	.127	.126	.127	.129	.132
Butter........................(lb.)	.510	.511	.527	.547	.557	.533	.503	.500	.502	.515	.531	.579
Oleomargarine.................(lb.)	.343	.349	.353	.356	.358	.351	.352	.351	.350	.352	.354	.361
Cheese........................(lb.)	.350	.347	.352	.352	.356	.353	.349	.346	.341	.342	.349	.360
Eggs.........................(doz.)	.493	.527	.561	.609	.554	.397	.383	.384	.391	.430	.467	.510
Sugar.........................(lb.)	.098	.099	.098	.097	.096	.094	.093	.093	.093	.094	.095	.099
Potatoes......................(pk.)	.434	.449	.441	.444	.436	.392	.336	.322	.456	.595	.567	.575
Beans, navy...................(lb.)	.188	.185	.184	.184	.180	.182	.180	.178	.176	.173	.173	.171
Onions........................(lb.)	.051	.051	.052	.053	.053	.049	.045	.050	.055	.057	.057	.055
Prunes........................(lb.)	.173	.172	.170	.170	.169	.169	.169	.169	.164	.165	.168	.171
Tomatoes...............(No. 2 can)	.168	.165	.161	.162	.163	.165	.166	.167	.163	.166	.169	.172
Peas...................(No. 2 can)	.177	.176	.175	.177	.177	.175	.178	.178	.177	.178	.181	.185
Corn...................(No. 2 can)	.177	.173	.171	.171	.171	.170	.172	.173	.172	.174	.177	.181
Salmon.................(No. 1 can)	.271	.271	.274	.275	.277	.272	.274	.277	.293	.298	.301	.305
Fish..........................(lb.)	.231	.234	.242	.257	.261	.257	.252	.244	.241	.249	.249	.255
Hens..........................(lb.)	.284	.279	.283	.298	.323	.342	.350	.341	.340	.343	.349	.351
Tea...........................(lb.)	.617	.618	.629	.627	.631	.621	.625	.630	.622	.625	.630	.636
Coffee........................(lb.)	.318	.317	.319	.320	.319	.306	.305	.305	.288	.284	.284	.284
Aggregates....................	$8.074	$8.105	$8.173	$8.298	$8.284	$8.037	$7.985	$8.013	$8.194	$8.436	$8.561	$8.787
Percentage of increase (+) or decrease (−) compared with the previous month..........................		+0.4	+0.8	+1.5	−0.2	−3.0	−0.6	+0.3	+2.3	+2.9	+1.5	+2.6

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* The monthly averages are made up of the averages of four or five weekly averages. The deciding factor as to what month a certain week's price belongs in, being the month which has the majority of days.

TABLE V.

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Wheat flour 1/16 bbl. bag		Wheat bread lb.		Cornmeal, bulk lb.		Oatmeal, bulk lb.		Rice lb.	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.829	$.822	$.102	$.076	$.067	*	$.087	$.075	$.120	$.106
Week ending 1917										
Oct. 6	.869	.834	.109	.072	.068	....	.089	.065	.109	.092
Oct. 13	.839	.824	.106	.078	.069	....	.090	.065	.109	.092
Oct. 20	.839	.824	.109	.078	.068	....	.089	.065	.110	.092
Oct. 27	.849	.824	.108	.074	.068	....	.088	.065	.111	.092
Nov. 3	.844	.824	.109	.078	.068	....	.088	.065	.110	.093
Nov. 10	.834	.819	.108	.075	.068	....	.088	.067	.110	.095
Nov. 17	.834	.814	.107	.074	.067	....	.089	.066	.112	.094
Nov. 24	.834	.819	.108	.075	.069	....	.088	.066	.111	.095
Dec. 1	.834	.819	.105	.075	.068	....	.088	.067	.112	.095
Dec. 8	.824	.819	.105	.075	.068	....	.087	.067	.112	.096
Dec. 15	.824	.814	.104	.075	.068	....	.087	.067	.113	.096
Dec. 22	.824	.819	.102	.075	.068	....	.087	.069	.112	.097
Dec. 29	.819	.819	.103	.072	.068	....	.087	.069	.112	.096
1918										
Jan. 5	.824	.819	.102	.075	.068	....	.088	.069	.114	.097
Jan. 12	.819	.819	.103	.075	.068	....	.088	.070	.114	.098
Jan. 19	.819	.819	.103	.075	.069	....	.088	.070	.114	.099
Jan. 26	.819	.819	.103	.076	.068	....	.088	.071	.114	.100
Feb. 2	.824	.819	.102	.076	.068	....	.087	.073	.115	.100
Feb. 9	.814	.814	.102	.075	.067	....	.087	.074	.115	.100
Feb. 16	.814	.814	.102	.075	.068	....	.087	.074	.115	.101
Feb. 23	.824	.814	.103	.075	.068	....	.088	.075	.117	.100
Mar. 2	.819	.814	.102	.075	.069	....	.087	.076	.116	.102
Mar. 9	.824	.814	.102	.076	.069	....	.088	.076	.117	.103
Mar. 16	.829	.839	.102	.076	.069	....	.088	.077	.118	.103
Mar. 23	.824	.844	.103	.076	.069	....	.088	.078	.118	.103
Mar. 30	.824	.849	.101	.077	.069	....	.089	.078	.118	.105
Apr. 6	.819	.849	.102	.078	.069	....	.090	.079	.118	.105
Apr. 13	.824	.844	.100	.078	.071	....	.093	.079	.119	.106
Apr. 20	.824	.844	.099	.078	.069	....	.090	.080	.120	.107
Apr. 27	.824	.844	.099	.076	.069	....	.091	.075	.119	.110
May 4	.824	.844	.099	.078	.069	....	.091	.080	.120	.110
May 11	.824	.844	.103	.078	.069	....	.092	.079	.121	.110
May 18	.824	.844	.099	.078	.069	....	.092	.080	.121	.111
May 25	.824	.844	.100	.078	.068	....	.092	.081	.121	.111
June 1	.824	.839	.100	.078	.068	....	.092	.080	.122	.112
June 8	.828	.810	.103	.078	.067	....	.086	.080	.123	.112
June 15	.820	.813	.099	.078	.066	....	.087	.081	.123	.114
June 22	.831	.810	.099	.078	.065	....	.085	.081	.125	.115
June 29	.828	.808	.099	.078	.066	....	.087	.080	.125	.115
July 6	.827	.808	.099	.077	.067	....	.085	.080	.126	.117
July 13	.828	.805	.099	.079	.065	....	.084	.080	.127	.116
July 20	.831	.809	.100	.078	.066	....	.085	.080	.128	.117
July 27	.833	.814	.099	.077	.065	....	.084	.080	.129	.116
Aug. 3	.836	.812	.100	.077	.067	....	.085	.081	.129	.118
Aug. 10	.836	.809	.099	.078	.066	....	.085	.081	.131	.119
Aug. 17	.837	.809	.099	.078	.067	....	.085	.080	.132	.118
Aug. 24	.839	.808	.099	.078	.066	....	.084	.081	.133	.120
Aug. 31	.837	.807	.099	.078	.066	....	.085	.081	.134	.119
Sept. 7	.840	.805	.098	.079	.066	....	.084	.081	.134	.120
Sept. 14	.836	.814	.099	.078	.066	....	.086	.081	.135	.121
Sept. 21	.834	.813	.099	.079	.066	....	.084	.081	.136	.122
Sept. 28	.837	.815	.099	.079	.066	....	.084	.080	.136	.121

* Indicates no quotations from Canada.

TABLE V—(*Continued.*)

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Round steak lb.		Bacon lb.		Ham lb.		Pork chops lb.		Lard lb.	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.329	$.318	$.498	$.504	$.437	*	$.363	$.373	$.329	$.347
Week Ending 1917										
Oct. 6	.291	.286	.462	.451	.397	....	.368	.335	.308	.312
Oct. 13	.295	.286	.468	.455	.402	....	.375	.339	.311	.317
Oct. 20	.294	.286	.475	.461	.405	....	.371	.342	.313	.319
Oct. 27	.292	.286	.478	.465	.412	....	.368	.345	.314	.319
Nov. 3	.292	.286	.478	.467	.405	....	.362	.343	.315	.321
Nov. 10	.289	.283	.479	.469	.404	....	.353	.346	.318	.329
Nov. 17	.290	.284	.477	.472	.405	....	.352	.348	.324	.323
Nov. 24	.290	.285	.483	.469	.407	....	.352	.346	.327	.324
Dec. 1	.288	.283	.481	.472	.408	....	.348	.346	.331	.329
Dec. 8	.288	.285	.488	.472	.409	....	.347	.349	.332	.328
Dec. 15	.289	.284	.482	.473	.411	....	.346	.345	.332	.330
Dec. 22	.290	.285	.484	.473	.410	....	.346	.345	.333	.329
Dec. 29	.289	.286	.489	.475	.409	....	.346	.344	.332	.329
1918										
Jan. 5	.290	.286	.489	.475	.413	....	.350	.346	.334	.333
Jan. 12	.292	.290	.488	.475	.412	....	.346	.345	.332	.335
Jan. 19	.294	.291	.488	.477	.415	....	.346	.350	.332	.333
Jan. 26	.295	.291	.491	.479	.417	....	.345	.353	.331	.335
Feb. 2	.298	.292	.493	.482	.419	....	.347	.356	.333	.335
Feb. 9	.298	.294	.492	.483	.418	....	.345	.353	.333	.338
Feb. 16	.298	.297	.491	.485	.417	....	.343	.358	.333	.337
Feb. 23	.300	.298	.488	.489	.419	....	.344	.361	.332	.337
Mar. 1	.301	.299	.491	.491	.423	....	.342	.361	.333	.339
Mar. 9	.301	.300	.482	.494	.419	....	.339	.360	.331	.339
Mar. 16	.303	.301	.482	.496	.415	....	.341	.364	.332	.341
Mar. 23	.305	.298	.486	.497	.419	....	.343	.364	.332	.343
Mar. 30	.307	.303	.484	.499	.421	....	.343	.365	.332	.347
Apr. 6	.311	.304	.488	.499	.422	....	.344	.369	.333	.348
Apr. 13	.317	.307	.490	.511	.427	....	.347	.376	.333	.348
Apr. 20	.329	.308	.494	.510	.431	....	.350	.379	.333	.347
Apr. 27	.335	.311	.494	.514	.432	....	.353	.379	.334	.348
May 4	.343	.317	.496	.518	.433	....	.355	.382	.332	.352
May 11	.345	.331	.494	.524	.434	....	.356	.391	.332	.356
May 18	.351	.336	.497	.529	.437	....	.359	.394	.333	.359
May 25	.354	.344	.496	.534	.437	....	.359	.396	.331	.366
June 1	.357	.349	.502	.534	.445	....	.361	.399	.331	.362
June 8	.365	.351	.508	.535	.459	....	.365	.399	.330	.368
June 15	.377	.352	.507	.535	.455	....	.369	.399	.329	.367
June 22	.379	.362	.511	.538	.463	....	.368	.402	.327	.370
June 29	.379	.367	.511	.537	.463	....	.371	.402	.330	.368
July 6	.377	.365	.512	.537	.465	....	.370	.399	.327	.368
July 13	.378	.367	.511	.536	.467	....	.372	.401	.328	.368
July 20	.378	.366	.514	.538	.468	....	.375	.399	.329	.368
July 27	.374	.364	.514	.537	.471	....	.377	.398	.327	.368
Aug. 3	.375	.361	.519	.541	.472	....	.381	.399	.329	.371
Aug. 10	.377	.360	.522	.541	.477	....	.386	.401	.328	.369
Aug. 17	.374	.359	.524	.542	.481	....	.391	.400	.330	.367
Aug. 24	.377	.362	.527	.542	.485	....	.399	.400	.332	.369
Aug. 31	.377	.358	.533	.544	.488	....	.401	.401	.333	.370
Sept. 7	.380	.356	.534	.541	.491	....	.409	.401	.333	.369
Sept. 14	.380	.351	.541	.539	.500	....	.418	.399	.335	.367
Sept. 21	.382	.352	.548	.544	.507	....	.426	.402	.336	.369
Sept. 28	.381	.347	.554	.535	.509	....	.430	.398	.336	.369

* Indicates no quotations from Canada.

TABLE V—(*Continued*).

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Milk qt.		Butter lb.		Oleomargarine lb.		Cheese lb.		Eggs doz.	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.126	$.098	$.526	$.522	$.352	*	$.350	$.305	$.476	$.542
Week ending 1917										
Oct. 6	.116	.087	.511	.495	.324	....	.348	.302	.482	.514
Oct. 13	.118	.089	.510	.499	.347	....	.349	.303	.488	.534
Oct. 20	.117	.090	.511	.505	.349	....	.351	.303	.490	.547
Oct. 27	.118	.091	.510	.508	.346	....	.351	.303	.498	.563
Nov. 3	.121	.091	.510	.511	.350	....	.352	.303	.508	.562
Nov. 10	.123	.095	.510	.513	.349	....	.351	.301	.512	.606
Nov. 17	.121	.097	.509	.512	.353	....	.350	.301	.514	.584
Nov. 24	.123	.097	.513	.513	.351	....	.351	.301	.537	.596
Dec. 1	.123	.097	.513	.513	.351	....	.352	.301	.543	.606
Dec. 8	.125	.097	.515	.513	.350	....	.352	.301	.551	.613
Dec. 15	.127	.098	.525	.513	.352	....	.351	.303	.557	.608
Dec. 22	.126	.098	.531	.511	.354	....	.352	.303	.563	.616
Dec. 29	.125	.098	.537	.510	.358	....	.352	.331	.574	.609
1918										
Jan. 5	.127	.098	.539	.513	.354	....	.351	.301	.590	.623
Jan. 12	.127	.098	.543	.513	.355	....	.352	.303	.593	.625
Jan. 19	.126	.099	.547	.512	.355	....	.352	.304	.610	.632
Jan. 26	.126	.099	.553	.513	.358	....	.352	.304	.623	.632
Feb. 2	.127	.099	.555	.516	.357	....	.354	.305	.631	.640
Feb. 9	.127	.099	.556	.522	.357	....	.353	.304	.618	.643
Feb. 16	.126	.099	.557	.528	.359	....	.355	.305	.573	.640
Feb. 23	.128	.099	.556	.534	.357	....	.357	.304	.545	.642
Mar. 2	.127	.098	.557	.540	.359	....	.358	.305	.480	.647
Mar. 9	.128	.099	.546	.537	.352	....	.353	.306	.410	.621
Mar. 16	.128	.099	.539	.543	.352	....	.354	.303	.394	.587
Mar. 23	.128	.099	.528	.545	.352	....	.354	.303	.394	.543
Mar. 30	.128	.099	.517	.549	.350	....	.353	.304	.390	.520
Apr. 6	.127	.100	.509	.549	.352	....	.352	.304	.385	.499
Apr. 13	.127	.100	.504	.547	.351	....	.350	.304	.383	.481
Apr. 20	.127	.099	.496	.548	.350	....	.349	.304	.382	.461
Apr. 27	.128	.100	.503	.548	.355	....	.346	.306	.382	.448
May 4	.128	.100	.501	.545	.351	....	.348	.305	.384	.442
May 11	.126	.100	.501	.541	.352	....	.346	.304	.384	.439
May 18	.127	.100	.501	.533	.351	....	.346	.303	.386	.435
May 25	.125	.099	.498	.532	.351	....	.344	.303	.383	.442
June 1	.127	.100	.499	.526	.351	....	.344	.303	.383	.445
June 8	.126	.099	.501	.522	.351	....	.342	.304	.385	.446
June 15	.125	.099	.498	.513	.352	....	.341	.304	.386	.447
June 22	.126	.099	.503	.514	.349	....	.339	.305	.392	.444
June 29	.126	.099	.506	.508	.349	....	.341	.306	.399	.457
July 6	.126	.098	.509	.510	.351	....	.340	.307	.408	.463
July 13	.127	.099	.512	.513	.351	....	.340	.306	.422	.477
July 20	.127	.098	.513	.512	.352	....	.342	.305	.433	.492
July 27	.127	.098	.518	.514	.351	....	.343	.305	.441	.491
Aug. 3	.129	.098	.522	.519	.353	....	.344	.307	.447	.513
Aug. 10	.129	.099	.524	.522	.353	....	.346	.309	.454	.527
Aug. 17	.129	.099	.528	.519	.353	....	.349	.308	.462	.525
Aug. 24	.131	.100	.533	.527	.355	....	.349	.309	.473	.537
Aug. 31	.129	.100	.539	.524	.356	....	.353	.308	.479	.537
Sept. 7	.131	.100	.546	.525	.355	....	.354	.309	.492	.544
Sept. 14	.132	.101	.562	.523	.360	....	.358	.307	.501	.542
Sept. 21	.133	.103	.591	.529	.363	....	.361	.310	.517	.557
Sept. 28	.133	.101	.619	.525	.367	....	.368	.307	.529	.554

*Indicates no quotations from Canada.

TABLE V—(*Continued*).

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Sugar lb.		Potatoes pk.		Beans lb.		Onions lb.		Prunes lb.	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.096	$.108	$.453	*	$.179	$.168	$.052	*	$.169	$.173
Week ending 1917										
Oct. 6	.098	.106	.419	....	.187	.165	.049	....	.171	.159
Oct. 13	.098	.106	.420	....	.187	.166	.051	....	.172	.160
Oct. 20	.098	.106	.433	....	.188	.167	.051	....	.176	.162
Oct. 27	.099	.106	.447	....	.189	.167	.051	....	.173	.162
Nov. 3	.099	.107	.449	....	.189	.167	.052	....	.174	.164
Nov. 10	.099	.107	.448	....	.186	.164	.051	....	.172	.164
Nov. 17	.099	.107	.451	....	.185	.162	.051	....	.171	.165
Nov. 24	.099	.108	.451	....	.186	.163	.051	....	.173	.164
Dec. 1	.099	.107	.445	....	.185	.164	.052	....	.172	.164
Dec. 8	.098	.107	.442	....	.184	.164	.052	....	.170	.164
Dec. 15	.099	.108	.440	....	.186	.163	.052	....	.172	.169
Dec. 22	.098	.108	.439	....	.182	.164	.052	....	.168	.171
Dec. 29	.098	.108	.441	....	.184	.165	.052	....	.169	.172
1918										
Jan. 5	.098	.108	.442	....	.185	.165	.052	....	.170	.170
Jan. 12	.098	.107	.442	....	.184	.164	.053	....	.170	.169
Jan. 19	.097	.107	.444	....	.183	.167	.053	....	.171	.173
Jan. 26	.097	.106	.444	....	.183	.167	.053	....	.170	.173
Feb. 2	.097	.106	.450	....	.183	.169	.054	....	.169	.173
Feb. 9	.097	.105	.445	....	.181	.168	.053	....	.168	.171
Feb. 16	.096	.105	.443	....	.181	.169	.053	....	.170	.172
Feb. 23	.096	.106	.422	....	.180	.164	.053	....	.170	.172
Mar. 2	.095	.105	.434	....	.179	.170	.052	....	.169	.172
Mar. 9	.095	.105	.421	....	.182	.169	.051	....	.168	.172
Mar. 16	.095	.105	.399	....	.182	.169	.050	....	.169	.172
Mar. 23	.094	.104	.382	....	.182	.169	.048	....	.169	.171
Mar. 30	.094	.104	.367	....	.182	.169	.046	....	.170	.173
Apr. 6	.094	.105	.352	....	.181	.170	.045	....	.169	.173
Apr. 13	.094	.106	.334	....	.180	.169	.044	....	.169	.175
Apr. 20	.093	.106	.330	....	.180	.169	.044	....	.169	.175
Apr. 27	.093	.106	.329	....	.179	.170	.045	....	.170	.176
May 4	.093	.107	.331	....	.179	.169	.046	....	.169	.176
May 11	.093	.108	.327	....	.179	.169	.049	....	.170	.177
May 18	.093	.108	.323	....	.177	.171	.049	....	.168	.175
May 25	.093	.108	.317	....	.177	.171	.051	....	.169	.177
June 1	.093	.108	.313	....	.177	.177	.053	....	.169	.176
June 8	.092	.108	.444	....	.175	.170	.054	....	.163	.177
June 15	.093	.109	.449	....	.178	.169	.056	....	.167	.176
June 22	.093	.109	.454	....	.175	.172	.055	....	.163	.176
June 29	.093	.109	.478	....	.175	.171	.056	....	.164	.177
July 6	.093	.108	.619	....	.174	.170	.056	....	.164	.179
July 13	.094	.109	.607	....	.174	.171	.057	....	.163	.179
July 20	.094	.109	.602	....	.173	.171	.057	....	.165	.178
July 27	.094	.109	.579	....	.173	.173	.057	....	.165	.182
Aug. 3	.095	.109	.568	....	.172	.170	.057	....	.166	.179
Aug. 10	.095	.110	.564	....	.173	.169	.057	....	.167	.181
Aug. 17	.095	.109	.569	....	.172	.170	.057	....	.167	.181
Aug. 24	.095	.111	.568	....	.173	.171	.057	....	.168	.181
Aug. 31	.095	.112	.569	....	.173	.170	.057	....	.170	.182
Sept. 7	.096	.114	.578	....	.171	.169	.056	....	.170	.184
Sept. 14	.097	.115	.574	....	.172	.169	.055	....	.171	.184
Sept. 21	.100	.118	.574	....	.171	.168	.055	....	.172	.183
Sept. 28	.102	.119	.572	....	.170	.168	.053	....	.173	.183

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* Indicates no quotations from Canada, or, if quoted, are quoted on unit bases not readily reduced to the United States unit.

TABLE V—(*Continued*).

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Canned tomatoes (No. 2 can)		Canned peas (No. 2 can)		Canned corn (No. 2 can)		Canned salmon, red (No. 1 can)	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.166	$.163	$.178	$.196	$.173	$.231	$.282	$.302
Week ending								
1917								
Oct. 6	.168	.141	.175	.160	.175	.189	.272	.264
Oct. 13	.169	.141	.181	.161	.178	.190	.271	.261
Oct. 20	.168	.143	.179	.170	.178	.196	.270	.269
Oct. 27	.168	.147	.177	.176	.178	.203	.271	.272
Nov. 3	.167	.149	.175	.179	.174	.210	.271	.275
Nov. 10	.167	.154	.177	.188	.175	.225	.271	.281
Nov. 17	.165	.152	.176	.186	.173	.216	.272	.278
Nov. 24	.165	.153	.175	.187	.173	.219	.272	.290
Dec. 1	.163	.154	.177	.188	.171	.225	.271	.281
Dec. 8	.161	.154	.171	.189	.173	.223	.270	.287
Dec. 15	.162	.155	.175	.192	.170	.226	.275	.290
Dec. 22	.159	.155	.177	.193	.170	.225	.275	.289
Dec. 29	.161	.155	.176	.193	.170	.227	.276	.289
1918								
Jan. 5	.161	.164	.177	.193	.172	.229	.275	.288
Jan. 12	.161	.165	.176	.193	.170	.230	.274	.293
Jan. 19	.163	.167	.176	.194	.170	.231	.275	.295
Jan. 26	.163	.165	.179	.194	.172	.232	.276	.295
Feb. 2	.164	.166	.177	.195	.171	.232	.273	.297
Feb. 9	.163	.166	.176	.197	.170	.231	.274	.293
Feb. 16	.162	.165	.176	.197	.171	.232	.275	.293
Feb. 23	.163	.166	.178	.198	.172	.232	.278	.298
Mar. 2	.165	.165	.180	.201	.172	.233	.280	.303
Mar. 9	.164	.166	.173	.199	.168	.234	.272	.303
Mar. 16	.165	.165	.175	.198	.170	.233	.272	.307
Mar. 23	.165	.167	.177	.199	.171	.234	.273	.305
Mar. 30	.165	.167	.176	.198	.171	.234	.272	.306
Apr. 6	.166	.167	.177	.198	.171	.234	.274	.304
Apr. 13	.166	.167	.178	.200	.171	.236	.274	.306
Apr. 20	.166	.167	.178	.199	.173	.236	.274	.306
Apr. 27	.166	.166	.179	.199	.172	.234	.275	.308
May 4	.166	.168	.177	.201	.172	.236	.275	.308
May 11	.168	.167	.179	.200	.173	.236	.277	.311
May 18	.166	.168	.178	.203	.173	.238	.276	.310
May 25	.166	.168	.177	.202	.173	.239	.276	.315
June 1	.168	.168	.179	.203	.174	.240	.279	.309
June 8	.164	.168	.177	.204	.171	.239	.291	.313
June 15	.162	.170	.176	.204	.172	.239	.293	.314
June 22	.163	.169	.176	.204	.172	.240	.294	.313
June 29	.165	.169	.177	.203	.172	.239	.295	.314
July 6	.165	.169	.177	.204	.173	.240	.296	.315
July 13	.166	.170	.178	.204	.173	.241	.296	.316
July 20	.166	.171	.178	.204	.173	.242	.298	.317
July 27	.167	.171	.177	.205	.174	.242	.298	.315
Aug. 3	.168	.171	.179	.203	.175	.243	.300	.319
Aug. 10	.168	.171	.178	.203	.176	.243	.300	.319
Aug. 17	.168	.171	.181	.203	.177	.245	.300	.323
Aug. 24	.169	.169	.181	.202	.178	.244	.301	.325
Aug. 31	.170	.169	.183	.202	.179	.243	.303	.323
Sept. 7	.171	.169	.183	.202	.179	.243	.303	.324
Sept. 14	.172	.167	.184	.201	.182	.243	.304	.324
Sept. 21	.172	.169	.185	.201	.182	.244	.305	.327
Sept. 28	.173	.170	.187	.202	.183	.245	.308	.330

TABLE V—(*Concluded*).

STATEMENT SHOWING AVERAGE OF PRICES WEEK BY WEEK DURING THE ANNUAL PERIOD FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES IN THE UNITED STATES AND ON 22 IN CANADA.

Average price for	Fish lb.		Hens lb.		Tea lb.		Coffee lb.	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The year	$.247	$.180	$.323	*	$.626	$.540	$.304	$.422
Week ending 1917								
Oct. 6	.227	.180	.279	....	.616	.493	.318	.405
Oct. 13	.224	.180	.289	....	.621	.493	.321	.405
Oct. 20	.231	.186	.285	....	.617	.494	.320	.403
Oct. 27	.242	.180	.285	....	.612	.493	.314	.403
Nov. 3	.229	.183	.281	....	.619	.496	.317	.402
Nov. 10	.236	.178	.278	....	.617	.493	.316	.399
Nov. 17	.235	.181	.279	....	.614	.497	.319	.401
Nov. 24	.230	.178	.278	....	.626	.497	.320	.402
Dec. 1	.235	.178	.279	....	.615	.493	.315	.399
Dec. 8	.237	.180	.279	....	.628	.496	.317	.401
Dec. 15	.236	.182	.282	....	.625	.500	.318	.404
Dec. 22	.247	.185	.284	....	.627	.502	.321	.403
Dec. 29	.249	.179	.287	....	.634	.502	.321	.407
1918								
Jan. 5	.251	.178	.291	....	.631	.501	.320	.405
Jan. 12	.249	.180	.292	....	.626	.504	.318	.405
Jan. 19	.256	.185	.296	....	.626	.501	.320	.404
Jan. 26	.265	.183	.302	....	.629	.503	.321	.405
Feb. 2	.263	.183	.309	....	.625	.505	.319	.405
Feb. 9	.259	.180	.315	....	.627	.508	.320	.406
Feb. 16	.264	.176	.321	....	.633	.511	.319	.402
Feb. 23	.258	.178	.328	....	.631	.509	.318	.407
Mar. 2	.265	.172	.326	....	.633	.510	.320	.407
Mar. 9	.257	.180	.339	....	.619	.511	.307	.407
Mar. 16	.256	.183	.340	....	.624	.511	.305	.408
Mar. 23	.257	.179	.337	....	.624	.512	.306	.407
Mar. 30	.258	.180	.351	....	.615	.511	.305	.409
Apr. 6	.254	.178	.354	....	.618	.511	.305	.409
Apr. 13	.251	.182	.356	....	.628	.511	.306	.412
Apr. 20	.252	.185	.349	....	.629	.511	.306	.409
Apr. 27	.250	.184	.341	....	.627	.512	.305	.410
May 4	.243	.186	.345	....	.631	.516	.309	.409
May 11	.247	.187	.342	....	.628	.556	.305	.422
May 18	.245	.188	.339	....	.630	.573	.304	.429
May 25	.243	.181	.340	....	.631	.583	.305	.435
June 1	.244	.182	.340	....	.632	.586	.302	.442
June 8	.242	.180	.339	....	.628	.585	.292	.439
June 15	.241	.183	.340	....	.617	.581	.287	.444
June 22	.240	.181	.341	....	.625	.580	.287	.444
June 29	.243	.179	.341	....	.619	.593	.286	.442
July 6	.244	.183	.342	....	.622	.599	.285	.445
July 13	.245	.178	.342	....	.626	.597	.284	.447
July 20	.248	.179	.343	....	.629	.600	.285	.446
July 27	.258	.183	.343	....	.622	.597	.283	.457
Aug. 3	.248	.180	.346	....	.625	.594	.285	.459
Aug. 10	.248	.179	.349	....	.626	.605	.284	.449
Aug. 17	.247	.183	.345	....	.630	.608	.285	.450
Aug. 24	.251	.175	.351	....	.634	.609	.284	.456
Aug. 31	.249	.177	.349	....	.630	.605	.283	.451
Sept. 7	.253	.177	.351	....	.630	.609	.284	.451
Sept. 14	.255	.172	.352	....	.643	.606	.285	.450
Sept. 21	.255	.172	.354	....	.632	.609	.283	.456
Sept. 28	.256	.174	.347	....	.640	.609	.284	.451

***Indicates no quotations from Canada.**

TABLE VI (A).

AVERAGE AND RELATIVE WEEKLY RETAIL PRICES ON THE COMMODITIES NAMED, FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918 (THE AVERAGE PRICE FOR OCTOBER 1917, TAKEN AS 100).

	Wheat flour 1/16 bbl. bag		Cornmeal lb.		Rice lb.		Potatoes lb.	
	Average price	Relative price	Average price	Relative price	Average price	Relative price	Average price	Relative price
Average	$.848	100.0	$.068	100.0	$.110	100.0	$.434	100.0
Week ending 1917								
Oct. 6...	.869	102.5	.068	100.0	.109	99.1	.419	96.5
Oct. 13...	.839	98.9	.069	101.5	.109	99.1	.420	96.8
Oct. 20...	.839	98.9	.068	100.0	.110	100.0	.433	99.8
Oct. 27...	.849	100.1	.068	100.0	.111	100.9	.447	103.0
Nov. 3...	.844	99.5	.068	100.0	.110	100.0	.449	103.5
Nov. 10...	.834	98.3	.068	100.0	.110	100.0	.448	103.2
Nov. 17...	.834	98.3	.067	98.5	.112	101.8	.451	103.9
Nov. 24...	.834	98.3	.069	101.5	.111	100.9	.451	103.9
Dec.. 1...	.834	98.3	.068	100.0	.112	101.8	.445	102.5
Dec. 8...	.824	97.2	.068	100.0	.112	101.8	.442	101.8
Dec. 15...	.824	97.2	.068	100.0	.113	102.7	.440	101.4
Dec. 22...	.824	97.2	.068	100.0	.112	101.8	.439	101.1
Dec. 29...	.819	96.6	.068	100.0	.112	101.8	.441	101.6
1918								
Jan. 5...	.824	97.2	.068	100.0	.114	103.6	.442	101.8
Jan. 12...	.819	96.6	.068	100.0	.114	103.6	.442	101.8
Jan. 19...	.819	96.6	.069	101.5	.114	103.6	.444	102.3
Jan. 26...	.819	96.6	.068	100.0	.114	103.6	.444	102.3
Feb. 2...	.824	97.2	.068	100.0	.115	104.5	.450	103.7
Feb. 9...	.814	96.0	.067	98.5	.115	104.5	.445	102.5
Feb. 16...	.814	96.0	.068	100.0	.115	104.5	.443	102.1
Feb. 23...	.824	97.2	.068	100.0	.117	106.4	.422	97.2
Mar. 2...	.819	96.6	.069	101.5	.116	105.5	.434	100.0
Mar. 9...	.824	97.2	.069	101.5	.117	106.4	.421	97.0
Mar. 16...	.829	97.7	.069	101.5	.118	107.3	.399	91.9
Mar. 23...	.824	97.2	.069	101.5	.118	107.3	.382	88.0
Mar. 30...	.824	97.2	.069	101.5	.118	107.3	.367	84.6
Apr. 6...	.819	96.6	.069	101.5	.118	107.3	.352	81.1
Apr. 13...	.824	97.2	.071	104.4	.119	108.2	.334	76.9
Apr. 20...	.824	97.2	.069	101.5	.120	109.1	.330	76.0
Apr. 27...	.824	97.2	.069	101.5	.119	108.2	.329	75.8
May 4...	.824	97.2	.069	101.5	.120	109.1	.331	76.3
May 11...	.824	97.2	.069	101.5	.121	110.0	.327	75.3
May 18...	.824	97.2	.069	101.5	.121	110.0	.323	74.4
May 25...	.824	97.2	.068	100.0	.121	110.0	.317	73.0
June 1...	.824	97.2	.068	100.0	.122	110.9	.313	72.1
June 8...	.828	97.6	.067	98.5	.123	111.8	.331	76.3
June 15...	.820	96.7	.066	97.1	.123	111.8	.325	74.9
June 22...	.831	98.0	.065	95.6	.125	113.6	.334	76.9
June 29...	.828	97.6	.066	97.1	.125	113.6	.346	79.7
July 6...	.827	97.5	.067	98.5	.126	114.5	.619	142.6
July 13...	.828	97.6	.065	95.6	.127	115.5	.607	139.9
July 20...	.831	98.0	.066	97.1	.128	116.4	.602	138.7
July 27...	.833	98.2	.065	95.6	.129	117.3	.579	133.4
Aug. 3...	.836	98.6	.067	98.5	.129	117.3	.568	130.9
Aug. 10...	.836	98.6	.066	97.1	.131	119.1	.564	129.9
Aug. 17...	.837	98.7	.067	98.5	.132	120.0	.569	131.1
Aug. 24...	.839	98.9	.066	97.1	.133	120.9	.568	130.9
Aug. 31...	.837	98.7	.066	97.1	.134	121.8	.569	131.1
Sept. 7...	.840	99.1	.066	97.1	.134	121.8	.578	133.2
Sept. 14...	.836	98.6	.066	97.1	.135	122.7	.574	132.3
Sept. 21...	.834	98.3	.066	97.1	.136	123.6	.574	132.3
Sept. 28...	.837	98.7	.066	97.1	.136	123.6	.572	131.8

TABLE VI (B).

AVERAGE AND RELATIVE WEEKLY RETAIL PRICES ON COMMODITIES NAMED, FROM THE WEEK ENDING OCTOBER 6, 1917, TO SEPTEMBER 28, 1918. (THE AVERAGE PRICE FOR OCTOBER 1917 TAKEN AS 100.)

	Round steak lb.		Bacon lb.		Pork chops lb.		Lard lb.	
	Average price	Relative price	Average price	Relative price	Average price	Relative price	Average price	Relative price
Average	$.293	100.0	$.472	100.0	$.369	100.0	$.312	100.0
Week ending 1917								
Oct. 6...	.291	99.3	.462	97.9	.368	99.7	.308	98.7
Oct. 13...	.295	100.7	.468	99.1	.375	101.6	.311	99.7
Oct. 20...	.294	100.3	.475	100.6	.371	100.5	.313	100.3
Oct. 27...	.292	99.7	.478	101.3	.368	99.7	.314	100.6
Nov. 3...	.292	99.7	.478	101.3	.362	98.1	.315	101.0
Nov. 10...	.289	98.6	.479	101.5	.353	95.7	.318	101.9
Nov. 17...	.290	99.0	.477	101.1	.352	95.4	.324	103.8
Nov. 24...	.290	99.0	.483	102.3	.352	95.4	.327	104.8
Dec. 1...	.288	98.3	.481	101.9	.348	94.3	.331	106.1
Dec. 8...	.288	98.3	.483	102.3	.347	94.0	.332	106.4
Dec. 15...	.289	98.6	.482	102.1	.346	93.8	.332	106.4
Dec. 22...	.290	99.0	.484	102.5	.346	93.8	.333	106.7
Dec. 29...	.289	98.6	.489	103.6	.346	93.8	.332	106.4
1918								
Jan. 5...	.290	99.0	.489	103.6	.350	94.9	.334	107.1
Jan. 12...	.292	99.7	.488	103.4	.346	93.8	.332	106.4
Jan. 19...	.294	100.3	.488	103.4	.346	93.8	.332	106.4
Jan. 26...	.295	100.7	.491	104.0	.345	93.5	.331	106.1
Feb. 2...	.298	101.7	.493	104.4	.347	94.0	.333	106.7
Feb. 9...	.298	101.7	.492	104.2	.345	93.5	.333	106.7
Feb. 16...	.298	101.7	.491	104.0	.343	92.9	.333	106.7
Feb. 23...	.300	102.4	.488	103.4	.344	93.2	.332	106.4
Mar. 2...	.301	102.7	.491	104.0	.342	92.7	.333	106.7
Mar. 9...	.301	102.7	.482	102.1	.339	91.9	.331	106.1
Mar. 16...	.303	103.4	.482	102.1	.341	92.4	.332	106.4
Mar. 23...	.305	104.1	.486	103.0	.343	92.9	.332	106.4
Mar. 30...	.307	104.8	.484	102.5	.343	92.9	.332	106.4
Apr. 6...	.311	106.1	.488	103.4	.344	93.2	.333	106.7
Apr. 13...	.317	108.2	.490	103.8	.347	94.0	.333	106.7
Apr. 20...	.329	112.3	.494	104.7	.350	94.9	.333	106.7
Apr. 27...	.335	114.3	.494	104.7	.353	95.7	.334	107.1
May 4...	.343	117.1	.496	105.1	.355	96.2	.332	106.4
May 11...	.345	117.7	.494	104.7	.356	96.5	.332	106.4
May 18...	.351	119.8	.497	105.3	.359	97.3	.333	106.7
May 25...	.354	120.8	.496	105.1	.359	97.3	.331	106.1
June 1...	.357	121.8	.502	106.3	.361	97.8	.331	106.1
June 8...	.365	124.6	.506	107.2	.365	98.9	.330	105.8
June 15...	.377	128.7	.507	107.4	.369	100.0	.329	105.4
June 22...	.379	129.3	.511	108.3	.368	99.7	.327	104.8
June 29...	.379	129.3	.511	108.3	.371	100.5	.330	105.8
July 6...	.377	128.7	.512	108.5	.370	100.3	.327	104.8
July 13...	.378	129.0	.511	108.3	.372	100.8	.328	105.1
July 20...	.378	129.0	.514	108.9	.375	101.6	.329	105.4
July 27...	.374	127.6	.514	108.9	.367	99.5	.327	104.8
Aug. 3...	.375	128.0	.519	109.9	.381	103.3	.329	105.4
Aug. 10...	.377	128.7	.522	110.6	.386	104.6	.328	105.1
Aug. 17...	.374	127.6	.524	111.0	.391	106.0	.330	105.8
Aug. 24...	.377	128.7	.527	111.7	.399	108.1	.332	106.4
Aug. 31...	.377	128.7	.533	112.9	.401	108.7	.333	106.7
Sept. 7...	.380	129.7	.534	113.1	.409	110.8	.333	106.7
Sept. 14...	.380	129.7	.541	114.6	.418	113.3	.335	107.4
Sept. 21...	.382	130.4	.548	116.1	.426	115.4	.336	107.7
Sept. 28...	.381	130.0	.554	117.4	.430	116.5	.336	107.7

TABLE VII.

STATEMENT SHOWING AVERAGE OF PRICES, WEEK BY WEEK, DURING THE QUARTERLY PERIOD FROM OCTOBER 5, 1918, TO DECEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES FOR THE UNITED STATES AND ON 22 FOR CANADA

Average price for	Wheat flour 1/16 bbl. bag		Wheat bread lb.		Corn-meal, bulk lb.	Oatmeal, bulk lb.		Rice lb.	
	United States	Canada	United States	Canada	United States	United States	Canada	United States	Canada
The quarter	$.826	$.823	$.098	$.079	$.064	$.082	$.082	$.138	$.124
Week ending									
Oct. 5....	.834	.815	.099	.073	.066	.085	.081	.137	.122
Oct. 13....	.834	.822	.099	.080	.066	.083	.081	.138	.123
Oct. 19....	.833	.821	.099	.080	.066	.085	.082	.139	.121
Oct. 26....	.832	.820	.099	.080	.066	.086	.081	.139	.124
Nov. 2....	.831	.823	.099	.080	.066	.081	.083	.139	.124
Nov. 9....	.828	.822	.098	.079	.065	.080	.082	.139	.124
Nov. 16....	.824	.830	.098	.078	.064	.080	.082	.139	.123
Nov. 23....	.821	.829	.098	.079	.064	.081	.082	.139	.125
Nov. 30....	.822	.823	.098	.079	.063	.081	.081	.138	.125
Dec. 7....	.822	.825	.099	.079	.063	.080	.082	.139	.125
Dec. 14....	.822	*	.098	*	.063	.080	*	.138	*
Dec. 21....	.818	*	.097	*	.063	.080	*	.138	*
Dec. 28....	.813	*	.099	*	.063	.079	*	.138	*

Average price for	Steak, round lb.		Bacon lb.		Ham lb.	Pork chops lb.		Lard lb.	
	United States	Canada	United States	Canada	United States	United States	Canada	United States	Canada
The quarter	$.374	$.315	$.574	$.541	$.521	$.414	$.401	$.340	$.371
Week ending									
Oct. 5....	.381	.349	.562	.544	.514	.435	.405	.340	.372
Oct. 12....	.381	.347	.563	.539	.514	.432	.406	.340	.369
Oct. 19....	.377	.347	.566	.539	.515	.427	.403	.340	.370
Ort. 26....	.376	.345	.570	.541	.518	.421	.407	.341	.371
Nov. 2....	.374	.343	.571	.539	.519	.415	.402	.341	.372
Nov. 9....	.373	.360	.574	.543	.520	.413	.400	.339	.373
Nov. 16....	.375	.342	.575	.539	.511	.414	.398	.341	.369
Nov. 23....	.371	.339	.576	.539	.523	.411	.398	.340	.371
Nov. 30....	.373	.338	.575	.544	.523	.410	.395	.342	.370
Dec. 7....	.369	.338	.579	.542	.526	.406	.396	.341	.369
Dec. 14....	.371	*	.582	*	.526	.404	*	.340	*
Dec. 21....	.370	*	.581	*	.529	.401	*	.340	*
Dec. 28....	.376	*	.587	*	.532	.399	*	.339	*

* Indicates no quotations from Canada.

TABLE VII—(*Continued*).

STATEMENT SHOWING AVERAGE OF PRICES, WEEK BY WEEK, DURING THE QUARTERLY PERIOD FROM OCTOBER 5, 1918, TO DECEMBER 28 1918, ON 28 STAPLE FOOD ARTICLES FOR THE UNITED STATES AND ON 22 FOR CANADA

Average price for	Milk qt.		Butter lb.		Oleomargarine lb.	Cheese lb.		Eggs, fresh doz.	
	United States	Canada	United States	Canada	United States	United States	Canada	United States	Canada
The quarter	$.143	$.109	$.668	$.565	$.381	$.402	$.319	$.639	$.642
Week ending									
Oct. 5....	.137	.105	.635	.540	.371	.375	.311	.543	.577
Oct. 12....	.139	.106	.635	.551	.374	.378	.313	.555	.596
Oct. 19....	.140	.106	.635	.556	.375	.384	.313	.564	.603
Oct. 26....	.140	.106	.637	.561	.377	.389	.315	.583	.617
Nov. 2....	.142	.108	.640	.564	.381	.395	.319	.605	.636
Nov. 9....	.143	.111	.645	.571	.382	.399	.321	.622	.656
Nov. 16....	.144	.112	.651	.574	.383	.402	.321	.641	.648
Nov. 23....	.145	.113	.664	.577	.383	.406	.323	.669	.687
Nov. 30....	.146	.113	.673	.577	.384	.411	.330	.691	.697
Dec. 7....	.146	.114	.688	.576	.385	.415	.325	.705	.701
Dec. 14....	.147	*	.701	*	.386	.422	*	.709	*
Dec. 21....	.146	*	.709	*	.386	.424	*	.720	*
Dec. 28....	.147	*	.707	*	.387	.428	*	.704	*

Average price for	Sugar lb.		Potatoes pk.		Beans, white lb.		Onions lb.	Prunes lb.	
	United States	Canada	United States	Canada	United States	Canada	United States	United States	Canada
The quarter	$.108	$.122	$.503	*	$.163	$.165	$.047	$.177	$.189
Week ending									
Oct. 5....	.104	.121	.560	*	.169	.167	.052	.175	.183
Oct. 12....	.105	.121	.540	*	.168	.167	.051	.176	.186
Oct. 19....	.106	.121	.531	*	.169	.165	.049	.178	.186
Oct. 26....	.107	.122	.517	*	.167	.165	.048	.170	.187
Nov. 2....	.107	.123	.495	*	.166	.165	.048	.177	.188
Nov. 9....	.108	.122	.506	*	.166	.166	.047	.178	.191
Nov. 16....	.108	.121	.494	*	.163	.165	.046	.178	.191
Nov. 23....	.109	.122	.489	*	.162	.163	.045	.176	.195
Nov. 30....	.109	.124	.484	*	.161	.162	.045	.179	.193
Dec. 7....	.109	.123	.479	*	.159	.160	.045	.178	.193
Dec. 14....	.109	*	.474	*	.158	*	.045	.179	*
Dec. 21....	.109	*	.476	*	.157	*	.044	.179	*
Dec. 28....	.109	*	.490	*	.158	*	.046	.180	*

* Indicates no quotations from Canada, or, if quoted, are quoted on unit bases not readily reduced to the United States unit.

TABLE VII—(*Concluded*).

STATEMENT SHOWING AVERAGE OF PRICES, WEEK BY WEEK, DURING THE QUARTERLY PERIOD FROM OCTOBER 5, 1918, TO DECEMBER 28, 1918, ON 28 STAPLE FOOD ARTICLES FOR THE UNITED STATES AND ON 22 FOR CANADA

Average price for	Canned tomatoes No. 2 can		Canned peas No. 2 can		Canned corn No. 2 can		Canned salmon tall red No. 1 can	
	United States	Canada	United States	Canada	United States	Canada	United States	Canada
The quarter	$.176	$.165	$.191	$.198	$.188	$.242	$.314	$.336
The week ending								
Oct. 5	.175	.169	.188	.200	.186	.242	.308	.335
Oct. 12	.174	.169	.189	.200	.186	.243	.308	.330
Oct. 19	.175	.168	.190	.202	.186	.246	.310	.334
Oct. 26	.174	.167	.189	.199	.187	.244	.312	.336
Nov. 2	.175	.165	.191	.199	.189	.244	.313	.336
Nov. 9	.175	.165	.191	.200	.189	.242	.313	.338
Nov. 16	.176	.164	.190	.198	.189	.242	.315	.337
Nov. 23	.176	.161	.191	.194	.189	.239	.316	.337
Nov. 30	.176	.159	.193	.194	.189	.242	.315	.341
Dec. 7	.176	.158	.193	.193	.190	.239	.317	.337
Dec. 14	.179	*	.193	*	.189	*	.317	*
Dec. 21	.179	*	.192	*	.189	*	.317	*
Dec. 28	.179	*	.194	*	.190	*	.317	*

Average price for	Fish lb.		Hens lb.	Tea lb.		Coffee lb.	
	United States	Canada	United States	United States	Canada	United States	Canada
The quarter	$.258	$.176	.$353	$.651	$.621	.$291	$.468
The week ending							
Oct. 5	.256	.173	.353	.645	.610	.285	.455
Oct. 12	.261	.178	.353	.641	.616	.284	.459
Oct. 19	.251	.176	.352	.646	.617	.285	.461
Oct. 26	.253	.175	.355	.650	.622	.286	.461
Nov. 2	.254	.175	.355	.645	.624	.288	.465
Nov. 9	.257	.175	.355	.653	.628	.286	.464
Nov. 16	.257	.177	.350	.651	.620	.288	.462
Nov. 23	.256	.174	.353	.662	.621	.290	.468
Nov. 30	.259	.178	.355	.656	.625	.290	.464
Dec. 7	.259	.178	.351	.650	.627	.294	.466
Dec. 14	.260	*	.351	.653	*	.298	*
Dec. 21	.265	*	.351	.648	*	.303	*
Dec. 28	.263	*	.351	.657	*	.303	*

* Indicates no quotations from Canada.

OBITUARY NOTE.

Anders Nicolai Kiaer was born at Drammen, Norway, on September 15, 1838, and died at Christiania, April 16, 1919, when he was eighty years of age. Most of his working life was devoted to the study of statistics, national and international, and for a period of more than fifty years, beginning before the sixth International Statistical Congress at Florence in 1867, and ending after the fourteenth and latest biennial session of the International Statistical Institute at Vienna in 1913, he toiled in this field. The International Statistical Congresses elicited the publication of various works on international statistics and among them one by Kiaer on international shipping statistics published in four parts, between 1876 and 1892, and dealing with the merchant marines of various countries, the movement of shipping, and the diverse systems of harmonizing them.

Kiaer attended the Jubilee meeting of the Royal Statistical Society at London in 1885, a leading object of which was to consider the possibility of establishing an International Statistical Association, and there he took part in renewing the ties binding together the statisticians of the various countries, ties many of which had been broken as a result of the Franco-Prussian War and the termination soon after of the series of International Statistical Congresses. At that time the International Statistical Institute was founded, an organization which for thirty years has had one of its vice-presidents a Frenchman, and one a German, while its three presidents have been chosen in succession from England, Austria and Italy. Throughout these thirty years no member worked more unremittingly than Kiaer for the welfare and productivity of the new association, and at the end he shared with Major Craigie the distinction of having attended all but one of the fourteen biennial sessions of that body. He was among the ten Europeans, only three of whom, I believe, survived him, who attended the one meeting of the Institute which has assembled outside of Europe, that at Chicago, in 1893. He presented to the Institute several committee reports on the representative method in statisticsas distinguished from the method of complete enumeration and on demographicinquiries in little known countries or those in which no census had ever been taken. But in later years no subject absorbed more of his time than the birth rate and the fertility of marriages. At the Berlin session of 1903 he made a report on it and presented two works dealing with it, one Norwegian, the other international, which he had recently published. Two years later, at the London meeting, he offered another report on these themes, and again at Christiana in 1897 a further report came from the same source.

W. F. W.

AN ATTEMPT AT A STATISTICAL DETERMINATION OF THE BIRTH RATE IN THE UNITED STATES BY A. N. KIAER, EX-DIRECTOR OF THE STATISTICAL BUREAU OF NORWAY, HONORARY MEMBER OF THE AMERICAN STATISTICAL ASSOCIATION.

The following article was the author's last work and unfortunately he did not live to see it through the press. As the biographical sketch indicates, hardly any writer anywhere and probably no American is more familiar than Director Kiaer with the abundant statistical literature dealing with the fall of the birth rate in most civilized countries. The present study is of importance as an example of method in this field in a case where registration figures are inadequate or lacking.

Internal evidence seems to indicate that the writer did not have access in Norway to certain primary American sources and recent official publications, and that at some points, as was natural and almost inevitable, he misunderstood American practice. Had he lived, these defects would doubtless have been brought to his attention through correspondence and corrected by him. In view of his death, it has seemed well to publish so much of the study as has methodological value, and at the same time to point out in editorial notes how his material might have been supplemented or his interpretations modified. The article grew in part out of correspondence with an American friend, Walter F. Willcox, to whom the manuscript was sent and by whom it has been prepared for publication. Those changes which call attention to other material or involve a probable difference of judgment between author and editor have been signed in order that the source of each statement or query may be made clear.

In May, 1918, Dr. Kiaer wrote a long letter to Dr. Willcox about an international study of the falling birth rate upon which he was engaged, and asked advice on certain points regarding the birth rate in the United States and its changes. This letter at the close raised these questions.

1. May it be assumed that the infant mortality in the United States is about the same as in Massachusetts?

2. May it be assumed that the general mortality in the United States exceeded the mortality of the registration area in the same year by 4 or 5 per cent.?

3. Is it probable that the difference between the reported birth rate in Maine, Vermont, Massachusetts, Connecticut and Michigan taken together and the unknown birth rate in the whole United States decreased by a little more than one-half between 1898 and 1908 as the writer's figures indicated?

4. Is it probable that the number of alien emigrants from the United States in the period 1901–07 was about 32 per cent. of the number of alien immigrants in the same period?

These questions were received by Dr. Willcox in the summer of 1918, when the government work upon which he was engaged prevented his giving them the time and attention which their importance and the standing of the writer would have otherwise demanded. The following paragraphs from his reply of July 25, 1918, will aid the reader to follow Dr. Kiaer's argument in the article.

"With regard to your assumption that the infant mortality in the United States is probably not far from the same as that in Massachusetts, I am disposed to believe you have chosen the best obtainable basis, but that the infant mortality in Massachusetts is less, not greater, than that of the country as a whole.

"My reasons for this opinion are two. In the first place the public health movement in this country began earlier and has probably gone farther in Massachusetts than in any other part of the country. This is the universal opinion which has now found some support and basis in an excellent report of Dr. C. V. Chapin on the work of the various state boards of health in which, after devising a marking system, he concludes that Massachusetts is doing the best work in public health, with New York and Pennsylvania ranking nearly side by side in second place.*

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* Charles V. Chapin, Report on State Public Health Work based on a Survey of State Boards of Health made under the Direction of the Council on Health and Public Instruction of the American Medical Association, Chicago, 1916, pages 193 ff. Whether these three states still stand in the same relative position as when the survey was made may be doubtful.

"The other reason is that Massachusetts, notwithstanding the large number of foreign born, has a better educated population than the average and a very small proportion of Negroes among whom the infant mortality is very high.

"I reconcile this opinion with your conclusion that the infant mortality in the registration area is apparently less than that in Massachusetts,[*] by suggesting that infant deaths are less completely registered in other parts of the registration area, especially the states recently added to that group, than they are in Massachusetts. I am convinced that in most parts of the registration area, and especially in the rural districts, not a few deaths go unrecorded and that such omissions are more common among infants than among adults. Consequently, if I were to modify the infant mortality rates of Massachusetts for your purposes, I would increase rather than decrease them.

"Mr. Gannett's argument which you mention,[†] like that of Mr. King on the same subject in the *Political Science Quarterly* which you do not mention,[‡] is unconvincing because neither takes account of the change in the form of the age question in 1890 and because both assume that the results of a census may be checked by the results of registration, whereas in my opinion, at least under American conditions, the census is the more accurate measure and registration figures should if necessary be adjusted to agree with those of the census.

"Your second question, whether the death rate in this country is probably about the same as that of the registration area increased by perhaps 4 or 5 per cent. is discussed in my paper

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[*] With this conclusion of Dr. Kiaer's should now be compared the results reached in the Census Bureau's first and second annual reports on birth statistics for the registration area for births, including in 1915 the New England States, New York, Pennsylvania, District of Columbia, Michigan and Minnesota, and, in 1916, the same states with Maryland. The yearly deaths of children under one year of age per 1,000 living births shown by these reports were:

	1915.	*1916.*
Registration area	100	101
Massachusetts	101	100

showing that the infant mortality in Massachusetts is a fair representative of that in the registration area for births, but in no wise invalidating Dr. Kiaer's conclusion that the infant mortality in Massachusetts was higher than the average in the registration area for deaths which included many more states than the registration area for births. W. F. W.

[†] Am. Stat. Assn. Publications, IV (1894): 99–102.

[‡] Pol. Sce. Q. 12 (1897): 608–621.

on the death rate of the United States in 1900.* My reasons for thinking that there are, or were in recent years, significant omissions in the recorded deaths in New York State are set forth in various reports as consulting statistician to the New York State Department of Health, and in this respect I believe that New York is better off than most of the registration states.

"Regarding your third question, I believe that the difference between the birth rate of the United States and that of the five registration states did diminish to a significant degree between 1898 and 1908, but find it hard to accept the conclusion of your argument that the difference was reduced by more than one-half.

"The number of alien emigrants from the United States between 1900 and 1907 was probably more rather than less than one-third of the number of alien immigrants in the same period.

"On these four points, as you will see, I am in substantial agreement with your conclusions. The main question raised in my mind by your discussion is whether our American figures in these various fields are accurate enough to justify as refined an analysis as you have given them. I have hesitated to make a study of the birth rate in the United States or even in any of the states, because I have much doubt of the trustworthiness of the registration figures over a series of years. Still I hope very much that you will be able to prepare an article on this subject for the American Statistical Association."

After these preliminary explanations the substance of Dr. Kiaer's article follows:

How should the birth rate of the United States be estimated?

The American Census of 1900 gives the following information about the statistics of births: "In the census reports of 1880 and 1890 the number of births in the census years was estimated by adding to the number of living children returned as under one year of age on June 1 of each census year, the number who were born during the year but died before the date of the enumeration. . . . Unfortunately both factors are erroneous to a certain indeterminate extent. . . . The method of estimating the number of births in the census year, by addition of the population under one year of age and the 'born and died' has been followed in part . . . at the present census."[*]

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* Am. Stat. Assn. Publications X (1906): 137.

As this subject touches a fundamental point in the whole matter it is necessary to examine it at some length. It is obvious that if each of these two figures is correct their sum would give the number of births in the year before the census. In this way the births in Massachusetts were estimated.[†]

Children under one year of age enumerated June 1, 1900	60,492
Born and died in preceding year	6,736
Total births in census year	67,228

With this figure showing the estimated number of births in Massachusetts June 1, 1899, to May 31, 1900, we may compare the results of registration by averaging the births reported in 1899 and 1900, or by adding seven-twelfths of the births of 1899 to five-twelfths of the births in 1900. The former method shows 71,678 births in the census year, the latter 71,922, and the larger figure seems the better.[‡]

The best way to find the birth rate of a registration state with good records of births is to divide the number of births registered by the enumerated population. As far as I know this can be done with accuracy only for Massachusetts.[§]

The number of births in that state within the five-year period preceding June 1, 1900, was 359,581.[||] The next step is to compute how many deaths would have occurred among these births. March gives for each calendar year the deaths in Massachusetts at each year of age under five,* and from these figures we can estimate the number of deaths before June 1, 1900, among children born in Massachusetts between June 1, 1895, and May 31, 1900, inclusive, by using the following ratios derived from Norwegian, Swedish and German statistics.

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[*] Twelfth Census (1900), Vol. III, p. xlix. The Census of 1910 did not give any attention to the statistics of birth.

[†] *Ibid.*, p. 356.

[‡] The facts that Dr. Kiaer at this point quotes March's Stat. Intern. as his authority and that he does not anywhere in the article mention the Massachusetts registration reports in which births are shown by months, suggest that he may not have had access to that series. The number of births registered in the census year was 71,650 or 28 more than Kiaer estimates by one method, and 216 less than he estimates by the other. The estimate of the census thus falls short of the number registered by 4,422 or 6.2 per cent. W. F. W.

[§] With this opinion I cannot agree. The best test of the completeness and accuracy of birth registration in American states results, perhaps, from an effort to find a birth report for every infant whose death is reported. Recently the Bureau of the Census applied this test to the records of the New England States in 1916. In order of birth certificates not found, the states ranked as follows: New Hampshire, 5.6 per cent.; Vermont, 5.7; Massachusetts, 8.7; Maine, 9.5; Connecticut, 15.2; Rhode Island, 18.3. W. F. W.

[||] March, Stat. Intern., p. 44.

Year of Age at Death.	*Per Cent. of Children Dying Who Were Born in*	
	Later Calendar Year.	*Earlier Calendar Year.*
Under 1	70	30
1	60	40
2	55	45
3	50	50
4	50	50

As these three countries showed no marked differences it seems safe to apply the foregoing ratios to Massachusetts and assume for example that of children under one year of age dying between June 1, 1895, and May 31, 1896, about 70 per cent. had been born in the same period. On these assumptions 63,559 deaths would have occurred before the census in the quota of 359,581 births and 296,022 would survive. But the census found only 282,237.

As some of these were foreign born and others were natives of the United States, but not of Massachusetts, the next step is to estimate the balance of immigration and emigration among children under five years of age. Those in the state in 1900, who had been born abroad, numbered 6,846.† The number in Massachusetts born in other American states and the numbers in foreign countries or in other American states born in Massachusetts are unknown and must be estimated. We turn first to figures for the entire country. In 1900 there were in the United States 52,487 foreign born white children under five years of age, and 53,271 such foreign born children of all races. During the years 1908–10 the emigrants of all ages were 32 per cent. as numerous as the immigrants, and Mr. Willcox is of the opinion that between 1900 and 1907 the proportion was still larger.[*] But this proportion applies to persons of all ages, and for children under five years of age it may be very different. To estimate what it was, Swedish figures may be used. During the decade 1901–10 there were 13,195 children under five who left Sweden for non-European countries, and 7,000 such children entered Sweden, showing that the immigration of children largely from the United States was about 53 per cent. of their emigration, largely to the United States. But during the three years 1908–10 there were 431,050 alien immigrants to the United States under fourteen years of age (the number under five is not reported), and 38,046 such alien emigrants, or about 12 per cent. of the immigration, and for later years the ratio was similar. It seems probable that children born in the United States of alien parents and leaving the country with their parents were not counted as aliens and that this difference of practice explains the divergence between the Swedish and the American ratios. If that be so, the Swedish ratio is the one applicable to the present problem, and we may assume that American born children under five years of age leaving the United States are about one-half as numerous as such foreign born children arriving in the United States.[†] For the same reason we may assume that the number of children born in Massachusetts and migrating to some foreign country is about one-half of the children born abroad and migrating to Massachusetts.

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* *Idem.*, p. 819.

† Twelfth Census, Vol. II, p. 50.

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[*] Compare Am. Econ. Review. Supplement to Vol. 11, No. 1 (1912), pp. 66 ff.

[†] Dr. Kiaer's method is sound, but I suspect that he has misunderstood American figures and, in consequence, misinterpreted American conditions. Probably persons born in the United States and living in Canada are far more numerous than those living in any other foreign country. There were, 1,179,807 Canadians by birth in the United States in 1900, and 127,899 natives of the United States in Canada in 1901. From these figures it seems safe to infer that the number of American born children living in Canada was not far from 11 per cent. of the number of Canadian born children living in the United States. Even more significant are the figures for certain European countries. Thus in 1900 there were 840,513 persons living in the United States who had been born in England or Wales, and in 1901 there were 16,668 persons living in England and Wales who had been born in the United States. It seems safe to infer that the number of American born children living in England and Wales was not more than 2 per cent. of the number of English born children living in the United States. Following the same line of argument it seems probable that the number of American born children under five years of age living in the main countries of Continental Europe, France, Italy and Germany, in 1900, was not far from 2 per cent. of the number of children born in the foreign country and living in the United States. From a study of foreign censuses I inferred in 1899 that not far from 170,000 persons who had been born in the United States were living, in 1890, in foreign countries (The Decennial Census, p. 20). By 1900 that number had risen to perhaps 210,000 as a result mainly of an increase in American migration to Canada. If these figures are even approximately correct the emigration of natives of the United States during the years before 1910 was about 2 per cent. of the immigration of persons born abroad. W. F. W.

The next step is to estimate the interstate migration of children under five years of age. As the foreign born white children under five years of age in Massachusetts in 1900 were 0.81 per cent. of all the foreign born white in the state, it may be assumed that, of all the natives of other states living in Massachusetts and of all natives of Massachusetts living in other states, 0.81 per cent. also were under five years of age.* Arguing from these assumptions it appears that the number of children under five years of age in Massachusetts on June 1, 1900, as estimated from the sum of births and immigrants diminished by the sum of deaths and emigrants, should have been 296,022 which is 16,385, or 5.8 per cent., more than those found by the census. It seems best to accept the larger total.

The annual average number of births in Massachusetts between June 1, 1895, and May 31, 1900, was 71,916, and the estimated population at the middle of the period after making various adjustments was 2,722,825, from which the birth rate is computed at 26.41 per 1,000. The birth rate for the period from June 1, 1905, to May 31, 1910, computed in the same manner, was 25.14. For 1910 it appeared that the number of children enumerated should be increased by 9.02 per cent.

The method employed in these computations is applicable only to states in which registration is substantially complete. In other states, however, approximate results may be reached through inferences or assumptions based on the Massachusetts statistics or on those of other countries.

In this discussion, infant mortality figures are of primary importance because the number of deaths among the children born within a fixed period before the census day is the essential link between the registered number of births and the enumerated number of children living. The next step, therefore, is to estimate the mortality of children under five years of age in the United States. If the infant mortality figures of Massachusetts be taken as the starting point, allowance must be made for two differences between these population groups, the higher proportion of urban population in Massachusetts, and the lower proportion of colored. They are shown in the following comparison.

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* Here again the method is sound, but better figures than those to which Dr. Kiaer applied it are obtainable. From the Massachusetts census of 1885 (Vol. I, pp. 572 ff.) it appears that of the 297,834 natives of other American states then residing in Massachusetts 7,307, or 2.5 per cent., were under five years of age. For estimating the number of children born in other states and residing in Massachusetts at other dates, this proportion seems the best obtainable. For estimating the number of children among the natives of Massachusetts residing in other states the most that can be claimed for this ratio of 2.5 per cent. is that it is probably nearer the truth than the one adopted in the text. The figures at least suggest that the proportion of children among interstate migrants is several times as great as that among international migrants. W. F. W.

	Per Cent.		Per Cent.	
	White.	*Colored.*	*Urban.*	*Rural.*
		1900.		
United States	87.9	12.1	40.5	59.5
Massachusetts	98.7	1.3	91.5	8.5
		1910.		
United States	88.9	11.1	46.3	53.7
Massachusetts	98.8	1.2	92.8	7.2

What is the death rate of white children in American cities? The urban death rate of white children under one year of age per 1,000 living population of that age was

	Death Rate of White Infants in Cities.	
	1900.	*1910.*
In Massachusetts	190.6	166.6
New York	178.3	148.8
Pennsylvania	.....	158.7
Original registration states	180.0	156.6
Registration area	171.1	.....

In view of the evidence that public health work in Massachusetts is more efficient than in most other parts of the United States, the foregoing figures showing a higher mortality in Massachusetts at both dates suggest that, outside of Massachusetts at least, there were probably significant omissions in the recorded deaths of infant children.

A similar examination of the urban death rate of white children one to four years of age, inclusive, yields different results.

	Death of White Children One to Four Years of Age in Cities.	
	1900.	*1910.*
In Massachusetts	22.5	16.1
New York	27.8	19.1
Pennsylvania	....	19.6
Original registration states	24.9	17.5
Registration area	23.6	....

For this age period Massachusetts had at each date the lowest death rates, and the rates in the cities of the original registration states exceeded those in Massachusetts by about 10 per cent. In view of the uncertainty about the death rates of children under one year of age, and the much greater accuracy of the death rates at ages one to four, it seems admissible to assume that the death rates of white children under one year of age in the cities of Continental United States, as a class, exceeded the rate in Massachusetts cities by about 10 per cent. On that hypothesis the rates would be 190.6+19.1 or about 210 in 1900, and 166.7+16.7 or about 183 in 1910. For white children one to four years of age it seems best to extend the average rate in cities of the registration states to all American cities.

What is the death rate of colored children in American cities? In attacking this problem we cannot start with Massachusetts because the number of colored in its population is very small and the health conditions among colored in the state are not representative. Perhaps the best starting point is the death rate of colored children in cities of the original registration states. These should be increased 10 per cent. as the rates for white children were to allow for the probable excess in the rates outside of the registration states. On this hypothesis the death rates of colored children in cities were

	Under One Year.	*One to Four Years.*
1900	397.+39.7=437	55.7+5.6=61.3
1910	325.8+32.6=358	39.6+4.0=43.6

What is the infant mortality in the rural districts of the United States?

In his article on the "Death Rate in the United States in 1900," Mr. Willcox expressed the opinion that there was, in the United States, "no large and representative body of rural population wherein deaths are reported with sufficient completeness and accuracy to make the resultant death rates significant." Notwithstanding this difficulty, which is less serious now than in 1900, some estimate of that mortality is necessary to further progress with the present problem. The figures for white and colored must be kept separate. The next question then is, what is the white infant mortality in the rural districts of the United States? The best starting point, probably, is the white infant mortality of cities in the effort to estimate the probable relation between rural and urban infant mortality. Taking the infant mortality in cities at 100 per cent. the infant mortality of the rural districts in certain European countries was as follows:

Ratio of Rural to Urban Infant Mortality Per 1,000 Population at Age Specified.

(Latter = 100 per cent.)

Country.	*Under One Year.*	*One to Four Years.*	*Under Five Years.*
Norway	61.7	56.2	58.2
Sweden	74.3	70.8	68.3
Denmark	67.1	59.0	61.0
England and Wales	....	....	66.6
Average	67.1	62.0	63.5

If deaths in rural districts went unrecorded more commonly than in cities this fact would reduce percentages like the foregoing. This may be true to some degree even in Massachusetts, and is probably true to an important degree in the other registration states. The following ratios show that the difference between urban and rural infant mortality is greater in the United States than in Europe.

The fact that the ratio of rural to urban infant mortality among whites in 1900 was less in the United States than in Europe is probably connected with the fact that defects of registration in American rural districts were more common than in Europe and that, if any similar difference existed between American and European urban districts, it was smaller in amount. That the difference between urban and rural infant mortality in the United States diminished between 1900 and 1910 may plausibly be ascribed to improvements in the completeness of registration during the decade.

Ratio of Rural to Urban Infant Mortality per 1,000 Population at Age Specified.

(Latter = 100 per cent.)

			Whites.			
	1900.	*1910.*	*1900.*	*1910.*	*1900.*	*1910.*
	Under One Year.		*One to Four Years.*		*Under Five Years.*	
Original registration states	64.4	74.0	51.4	58.6	59.0	66.8
Massachusetts	67.4	79.4	61.3	70.2	63.3	72.9
New York	57.2	76.1	40.6	51.8	49.4	65.0
Pennsylvania	....	86.2	....	76.0	....	81.9
			Colored.			
Original registration states	55.1	54.8	44.7	53.8	50.9	54.3
Massachusetts	58.0	32.8	35.0	20.0	50.5	30.5
New York	44.1	47.7	28.1	38.2	36.1	41.0
Pennsylvania	....	69.0	....	59.8	....	62.3

The best assumption for 1900 apparently is that the death rate of white children under one year of age in the rural districts of the United States was to the same rate in the urban districts of the United States as the rate in the rural districts of Massachusetts was to the rate in the urban districts of Massachusetts, namely 67.4 per cent., a ratio very close to the average in the three Scandinavian countries, 67.1 per cent. But for 1910 the Massachusetts ratio of 79.4 per cent. seems too high to be probable. If it were correct the infant mortality in rural districts would have increased between 1900 and 1910 and that seems unlikely. The most plausible hypothesis apparently is that the white infant mortality in rural districts decreased 1900–10 at about the same rate as the white mortality at ages one to four and the urban white infant mortality. In Massachusetts the urban white infant mortality decreased 1900–10 by 12.6 per cent. and the rural mortality of white children one to four decreased by 18.2 per cent. Probably the rural white infant mortality decreased at something like the average of these rates, namely 15.4 per cent. The death rate of white infants in the cities of the registration area decreased 1900–10 by 8.5 per cent. and that of white children one to four years old in the rural districts of the registration area by 19.6 per cent. So the death rate of white infants in the rural districts of the registration area may be supposed to have fallen in the same decade by about 14 per cent.

We turn now to the question, What is the mortality of colored infants in the rural districts of the United States? Here the Massachusetts figures afford no satisfactory basis and it is best to start with those for the registration states. Probably these suffer from serious omissions and are consequently too low. On the whole, the fairest assumption seems to be that rural infant mortality bears to urban infant mortality the same numerical ratio among colored that it does among white.

By calculations such as these the probable death rates of children under one, one to four, and under five years of age in 1900 and 1910, both for urban and for rural districts and for white and colored in each, have been estimated.

The next step is to distribute the population of the United States at 1900 and 1910 between white and colored urban and rural and children and adult, in order that the infant mortality figures adopted as a result of the previous discussion may be applied to them. To understand the method as distinguished from the results of the paper, it is unnecessary to follow the details of the argument by which these estimates are made. They lead up to a classification of the population of the United States under five years of age on June 1, 1900, and July 1, 1910 into two age periods under one and one to four, each age group into white and colored, and each race group into urban and rural, or eight groups for each date. For each of these sixteen groups a death rate had previously been determined and by multiplying the population by the rate the probable number of deaths is computed. The net result of the calculation is to yield estimated infant death rates for the population, urban and rural, white and colored, as follows:

Computed Death Rates.

Age	*Massachusetts.* *1900.*	*Massachusetts.* *1910.*	*United States.* *1900.*	*United States.* *1910.*
Under 1	177.8	160.1	179.9	161.5
1 to 4	20.8	15.3	21.9	16.8
Under 5	54.4	46.4	54.9	46.9

These figures indicate that the infant mortality figures in the United States were higher than those in Massachusetts at both dates and give some measure of the excess. The question whether the differences in these two census years were typical of those in the four earlier years for which the rates are needed is then examined with the result that it seems reasonable to assume that the mortality of children under one in the United States was in 1896–1900 about 2 per cent. higher and in 1906–10 about 1 per cent. higher than in Massachusetts, and that the mortality of children one to four years of age at both dates was about 10 per cent. higher than in Massachusetts.

With the aid of the results thus far reached it is possible to estimate the number of births in each year of the two five-year periods before the censuses of 1900 and 1910 necessary to yield the number of surviving children under five years of age called for by the census results as revised to allow for probable omissions.[4] Then, by estimating the population in the middle of each of these ten years, the other terms of the ratio are secured and it becomes possible to compute birth rates. These computations lead to the following results:

Year.	*Estimated Population in Thousands.*	*Computed Births in Thousands.*	*Birth Rate per 1000.*	*Smoothed Birth Rate.*
1895–96	72,082	2,510	348	348
1896–97	73,383	2,443	333	333
1897–98	74,669	2,403	322	318
1898–99	75,998	2,273	299	304
1899–1900	77,389	2,277	292	292
1905–06	86,848	2,836	326	326
1906–07	88,718	2,851	321	313
1907–08	90,540	2,821	312	302
1908–09	92,090	2,521	274	292
1909–10	93,827	2,652	283	283

[4]

It will be noticed that in each five-year period much the sharpest fall in the birth rate was in the third of the four intervals. This is possibly if not probably due to errors in the census returns of children between one and two years of age, to which attention has been called in various countries. If the age returns are smoothed the resultant rates appear in the last column of the table.

Another point calling for explanation is the indicated increase in the birth rate between 1900 and 1906. This may plausibly be ascribed to the heavy immigration between those dates and its effect on the birth rate in the years immediately following. It is noteworthy that the average birth rate in the five registration states, Maine, Vermont, Massachusetts, Connecticut and Michigan, rose from 21.54 for 1901–05 to 23.84 for 1906–10, and that the most marked increase was for the year 1906.

A similar line of analysis has been carried back to include every census since the Civil War, computing the average birth rates for the three-year period and the five-year period preceding each census and averaging the results. The conclusions appear in the following summary:

Date of Census.	*Birth Rate for Preceding Period.*		*Average Rate.*	*Decennial Decrease.*
	Three Years.	*Five Years.*		
1870	380	400	390	
1880	361	389	375	15
1890	304	337	320	55
1900	306	319	312	8
1910	289	303	296	16

The excessive decline 1880–90 evidently needs explanation. That and the slight decline 1890–1900 are probably due to the change in the form of the age question in 1890 and the return in 1900 to the earlier form. If the rate in 1890 be raised from 320 to 342 to allow for this source of error and get a smooth series the birth rate in the United States underwent the following decreases figured as per cents of the initial average rate

	Per Cent. Decrease.
1868–78	4
1878–88	9
1889–98	9
1898–1908	5

indicating that the decrease during the last twenty years of the nineteenth century was much greater than during the first decade of the twentieth. In that respect the United States differs widely from most European countries where the decrease of the birth rate has been going on with accelerating speed as the following figures show.

	Average Annual Fall in Birth Rate in Per Cent. for	
Country.	*1870–1900.*	*1900–1912.*
England and Wales	0.72	1.55
France	0.58	1.17
Germany	0.33	2.02
Austria	0.64	1.15

The slower decrease in the American birth rate is probably due to the effects of heavy immigration during the early years of the present century.

To ascertain how much the annual number of births in the United States exceeds or falls short of the normal some standard of reference is needed. For this purpose the average birth rate among married women at each five-year age period of child bearing life in the three Scandinavian countries and Finland during the years 1871–94 have been accepted as the standard, and the number of births computed which would have occurred in the United States in 1900 and 1910 if the birth rate of American married women at each of the age groups had agreed with that of the corresponding group in the Scandinavian countries. Treating the results of such a computation as showing the normal number, the births in the United States in 1900 were 70 per cent. and in 1910 were 64 per cent. of the normal number. These percentages are higher than those of France, about the same as those of England, and lower than those of most other European countries.

SOME CONSIDERATIONS IN VITAL STATISTICS EDUCATION*

By Louis I. Dublin and Edwin W. Kopf.

The past decade has witnessed an encouraging growth in American vital statistics. The variety of the subjects inquired into, the expert methods employed and the increasing number of persons engaged in the work all indicate a wholesome development in this branch of knowledge. The federal registration service has been expanded until, at the present time, the records of mortality are collected and compiled for nearly 80 per cent., and the records of births for 53 per cent. of the population of the United States. The annual reports of both births and deaths, as now issued by the Bureau of the Census, are increasingly well constructed and significant documents. Tabulations of data on population structure, derived from the results of the 1910 Census, have become available in detail not displayed for any preceding enumeration. Our federal data now compare favorably with the best publications on vital statistics issued by the European countries. Along with this development have come also numerous contributions from the vital statistics offices of the several states and cities and from the laboratories of public and private agencies which have used vital statistics as an organ of public health work. It is instructive, therefore, to inquire whether, under these promising conditions, there has been a corresponding growth in the facilities for vital statistics education. Surely, the number of those who are competent to utilize the volume of data must be increased, and some thought must be given to the character and scope of the training of those who are to prepare and analyze our vital records.

For many years, the American Statistical Association was the only medium for the exchange of opinion on vital statistics practice in the United States. The early leaders of the Association, including Jarvis, Elliott, Walker and Shattuck actively promoted standards of legislation and of registration in the states and advocated a programme of Federal vital statistics. The QUARTERLY PUBLICATIONS of the Association, and the constant improvement of the character of our vital statistics, bear witness to the productive work of these men. The QUARTERLY was also the means wherein standards for the registration of vital data and for their analysis were discussed by official, academic and private statisticians. The American Statistical Association played a most important part in the founding and establishing of our vital statistics. Its interests, however, were general and not specific in this particular branch of statistical science. It was necessary, therefore, that an organization with more limited aims be founded and this was accomplished in 1907, with the organization of the Section on Vital Statistics in the American Public Health Association. This group was composed, for the most part, of registrars and statisticians connected with the United States Bureau of the Census and of a number of the leading state and municipal vital statistics offices. The founding of the section at once provided a means for the dissemination of the standards which had slowly been established by the best agencies in the country. The history of our vital statistics since 1907 has centered largely around this group of public health statisticians, many of whom are members also of the American Statistical Association. Rules of approved statistical practice have emanated from this section and the registrars who, for the most part, had secured no other training than through actual contact with their official material, have obtained safe guides for the conduct of their work. While this method is not altogether satisfactory as a means of training vital statisticians, it has been until recently virtually the only one available to those who aspired to some degree of competence in this field.

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* Read before the annual meeting of the American Statistical Association, Richmond, Va., December 28, 1918.

A few of the universities and colleges of the country at about this time became aware of their obligation to provide instruction to qualified students, and a few actually established definite courses in vital statistics. But from a survey of the announcements of the more important institutions, it seems that there is still wide variation of opinion as to what constitutes the material and the method of vital statistics. The definitions implied in these announcements seem to vary with the points of view of the departments in which the courses are given. In medical schools, occasional lectures on vital statistics are given in connection with courses in preventive medicine. In schools of hygiene and public health, the courses are subordinate to those on biometry, epidemiology or general public health administration. In schools of commerce and of business administration, vital statistics seems to be incidental to insurance and economics courses. The emphasis is then on the economic aspects of population and of its movement or functioning. Some of these courses are purely descriptive of the processes of registration and of tabulation of crude data; others emphasize the analytical or mathematical methods of the science to the virtual exclusion of descriptive subject matter. There is hardly any agreement upon what constitutes vital statistics; upon what elements of the science are constant in the several fields of its application; and upon what variations in the superstructure of vital statistics are necessary to teach the subject to the several types of students and workers. We shall, accordingly, in this statement, attempt to determine which groups are most in need of such instruction, and, second, to suggest a program of education in vital statistics adapted to these several groups. It is hoped that this outline will form the basis of productive discussion.

VITAL STATISTICS EDUCATION IN SCHOOLS OF GENERAL MEDICINE.

There are, first, the students of medicine, the future practitioners, who are to be the initial recorders of most of our vital statistics data, namely, those of birth, death, sickness and accident. The physicians of the country, in a very final way, determine the completeness of the count of our vital phenomena and the accuracy and the detail of statement. Instruction in vital statistics should, therefore, be planned as an essential element in their education. In view of the crowded condition of the medical curriculum, instruction should be introduced with moderation and discretion. Emphasis should be placed upon the urgency of complete and accurate registration especially of births, of deaths and the diseases causing death, and of cases of notifiable disease. Instruction should be given how properly to complete such official records. The future physician should know the uses to which such records are put by the health authorities of his community and the legal importance of these documents to his patients or their heirs. He should be familiar with the elementary processes necessary to derive the essential indices of community vital statistics such as birth rates, death rates, infant mortality rates, sickness rates, etc.

Instruction in vital statistics has, in addition, very important bearings upon the general education of the medical student. The value of future medical research will depend in some part upon the ability and readiness of physicians to record the essential facts in their cases and to derive from their records the underlying principles of their practice. The student of medicine should be taught to understand that the principles of his science are developed and advanced in two ways; first, by the so-called *intensive* and second, by the *extensive* method of observing vital phenomena and processes. The sciences of anatomy, physiology, histology and pathology represent the intensive approach. They represent the collection of facts and conclusions on the normal and abnormal in the structure and function of individuals and of their organs. They typify science in its description of individuals in terms of the individual. But the science of medicine also attempts to draw conclusions from the consideration of large groups of cases and the analysis of the data for such aggregations. The student should be taught that from this viewpoint vital statistics is in general the engine of research for establishing those conclusions which are based upon the proper observation of masses of cases. Thus, vital statistics in the school of medicine should be taught perhaps in the department of research medicine as a method of discovery of generalized medical truth.

VITAL STATISTICS EDUCATION IN SCHOOLS OF PUBLIC HEALTH.

Then there are the students and workers in public health and hygiene who must understand and use vital statistics in their specialty. In fact, the results of statistical inquiry are the very foundation and the guide for their programmes of operation. The development of statistical data and technique in America has been and will continue to be largely in their hands. Yet the larger number of public health workers have been, for the most part, trained in the hard school of experience with only the precepts of a few successful vital statisticians to guide them. They have entered their field with perhaps a training confined to the principles and practice of medicine obtained before the days of the modern schools of public health and have received hardly any formal or systematic instruction in statistical method. This is evident to any one who examines the large number of weekly, monthly and annual reports issued by the health departments of states and cities. For the most part these reports do not as yet attain the required standards of statistical practice. A very valuable source of information is thus impaired both for the use of the public and of the specialists in health work.

The students in graduate schools of public health are now much more fortunate. Courses in vital statistics are provided and these cover the field fairly extensively. In general, their instruction seems to cover the ground of such a text as Newsholme's or of Whipple's recent book. Courses for health officers should emphasize the value of registration and the need for sound legislation for the establishment and enforcement of such registration. There should be instruction in classification technique especially for such items as statements of cause of death and of occupation. Time should be given to tabulation practice and to statistical arithmetic including the preparation of graphic representations. Such courses should, in a sense, cover the entire field of demography, embracing the amount and extent of community losses which result from the incidence of communicable disease and preventable death. In view of the fact that support of health work in the last analysis depends upon public opinion, the student should receive instruction in the preparation of reports, of health literature and of exhibits which will portray the results of his work and the need for its maintenance and extension.

VITAL STATISTICS EDUCATION FOR STUDENTS OF SOCIAL AND POLITICAL SCIENCE.

There is also that large group of students of the social and political sciences who use vital statistics. Their chief interests are to determine the facts of the progress, decline and prospects of mankind. They need, therefore, to understand the composition and structure of population; the changes in such characteristics of population and their meaning, and the losses which result from preventable disease and premature death. The gains from migration and birth are likewise within the scope of the work of these students. They are concerned with the factors which determine differential birth rates and death rates. The facts of marriage and divorce in relation to family life are of special interest to them. A course for such students should, therefore, give the principal facts of descriptive demography. Less emphasis need be placed on registration and the methods of office procedure, which are so vital to the registrar and to the public-health worker, but more time must be spent on the relation of vital phenomena to other historical, social, and economic facts which bear upon the problems of life and death. Such allied considerations as family income, housing, working conditions, dietaries, etc., should be studied in relation to the public health. This will involve considerable instruction in the mathematical and logical treatment of facts. It is for this group of students especially that emphasis should be placed, in a vital statistics course, on the newer developments of mathematical statistics sufficient to qualify the student to determine the relation between variable phenomena and the degree of accuracy of the usual statistical measures.

VITAL STATISTICS EDUCATION FOR STUDENTS OF INSURANCE.

For nearly a century, actuaries and their students have been working more or less successfully in vital statistics. In fact, the higher forms of graduation and of analysis, so important in the field of vital statistics, have been developed by mathematicians and actuaries employed by the insurance companies as a necessary part of their business practice. In England and on the Continent, actuaries have laid the foundation for vital statistics, beginning with their contribution of life tables to the analysis of the phenomena of life and death.

A profitable field for the extension of vital statistics education is afforded by the group of students who prepare themselves for a career in actuarial science. While it will not be necessary to require of them a formal and thorough course such as given to public health students, it would be desirable for them to receive instruction in vital statistics as related to mortality. These students should become acquainted with the chief sources of information on population mortality. They should be familiar with the main facts of the death rates of groups of population by color, sex and age, especially for the more important diseases as causes of death. As the field of actuarial work widens, as new elements of risk, such as disability, sickness, old age dependency, occupational hazard, are added to underwriting work, more and more attention will need to be directed to official sources of data in American vital statistics. A closer bond between actuaries and the vital statisticians should in every way be encouraged.

There has not been, however, as much coöperation between actuaries and the other groups interested in the future progress of vital statistics as there might have been. This is perhaps due to the fact that until the Section on Vital Statistics of the American Public Health Association was formed, there was no organization whereby workers in the several fields could meet on a common ground and discuss the subject. In recent years, however, certain tendencies toward coöperation have become evident. The work of the Bureau of the Census, the Actuarial Society of America and the American Public Health Association in promoting the compilation of the "United States Life Tables" is an instance of what may be accomplished when the several groups work together for a common end. The Casualty Actuarial and Statistical Society has already endeavored to establish relations with those groups of vital statisticians who are interested in the subjects not comprised in the work of the life actuarial field. Subjects such as sickness statistics, especially the statistics of hospitals and other institutions, accident statistics, especially the facts for workmen's compensation cases, and other matters have been brought into the common field of the casualty actuary and the public health vital statistician, and discussed to great advantage.

In the foregoing text we have described various groups of students using vital statistics and its methods. It may be well at this point to condense the various suggestions as to programme into one statement, and this may be done as follows. These several groups of students need to be informed as to the content and purpose, first, of statistics in general, as a mode of approach to the facts of life, and second, as to vital statistics.

A BASIC PROGRAMME.

Statistics should be defined and taught as the method of collecting, tabulating and interpreting the facts for groups of persons, things, or events in terms of the groups. It should be shown that statistics produce various facts, whatever the subject-matter, and of these there are: (a) concrete facts of the kind or sort categories into which the individuals composing a group may be arranged, (b) the size classes into which the individual variates of a given kind or sort category may be displayed, (c) the convenient "shorthand" or averaging devices of statistics which enable one to grasp ideas of the size-type of a group; the degree of diversity of the individuals composing the group; the degree of association or correlation between one character of the group as compared with some other characteristic of the group, or with the same character of another group; the degree of symmetry of the distribution of the individuals composing the group. There should also be some instruction in the theory of probabilities as a means for determining the degree of approximation or reliability of the statistical measures employed, and in applied logic to test the validity of conclusions. Vital statistics, it should be shown, is the application of these methods and conceptions of statistics to vital phenomena.

Vital statistics itself may be further classed according to whether it treats of (a) the structure or composition of populations (static demography) and (b) the movement or functioning of such populations and their sub-divisions (dynamic demography). Under the subject of the structure and composition of population, the student should be taught the history and methods of census taking, the classification, tabulation and significance of the principal facts of population according to families, sex, age, country of birth, color or race, parentage, degree of education, mother tongue, etc. That branch of vital statistics which deals with the movement of population should take up in the descriptive and interpretive mode, the facts of birth, marriage, divorce, sickness, death and migration. In the treatment of these several subjects, the concepts and practical methods of statistics in general should be applied.

Under method, practical laboratory instruction should be given in the drafting of inquiry and registration schedules, the practical editing and criticism of returns, the preparation of tabulation sheets, cards, etc., the management of mechanical tabulating systems, of computing machines and reckoning devices, in the technique of authorship, in filing, finding and, the other disposition of published results, in graphic technique and in personal and office efficiency.

FOOD EXPENDITURES BY MEN AND WOMEN.

By Horace Secrist

In budgetary studies it is customary in apportioning family expenditures for food among the members to place the husband and wife in the ratio of 100 to 90.* The evidence in support of this distribution is frequently not given, and in some cases, undoubtedly, it rests on nothing more substantial than mere assumption.† As throwing light on this relationship, the results of a study recently conducted in the statistical laboratory of Northwestern University into the expenditures for food by men and women—mostly students and business people—at a local cafeteria may be of some value. They are given here in rough outline only, no more definite analysis being offered than the nature of the data seems to warrant.

In summary, it may be said that the result supports very closely the commonly used ratio of 90 per cent. for women to 100 per cent. for men.

The data were secured from the manager of a local (Evanston, Ill.) cafeteria, distinction being made by him on the checks paid by each customer, (1) between adults and children,‡ (2) between men and women, (3) between the days of the week, (4) between the meals of the day. Details were secured for one week, January 19 to 25, inclusive, 1919, and cover 6,843 individual meals. On the basis of 365 individual meals per year they represent an experience for breakfast of 2.29 years; for dinner, 8.86 years; for supper, 7.60 years; and for all meals (1,095 per year), 6.25 years. Stated in another way, the data represent for an individual man or woman yearly experiences for each of the meals as follows:

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* See, for instance, Monthly Labor Review, United States Bureau of Labor Statistics, October, 1917, p. 6; *ibid.*, December, 1918, p. 115.

† ". . . the relative consuming powers of the different members of the normal families were estimated after careful comparison and study, and on the basis of these estimates it was assumed as generally true for the purpose of this table—1, that all husbands consume a like amount of food; 2, that the wife consumes 90 per cent. as much food as the husband. . . ." Eighteenth Annual Report of the Commissioner of Labor, 1903, p. 102.

"In general, it appears that the food requirements of men and women of equal activities are in proportion to their bodily weights, and the amounts required by children varies primarily with age. Women, on the average, weigh about eight-tenths as much as men, and it is commonly assumed that if equally active their food requirements will stand in the same proportion." Monthly Review, December, 1917, p. 6.

‡ Inspection alone was relied on for this purpose, the age distinction being 14 years.

TABLE I.

TABLE SHOWING FOOD EXPENDITURE EXPERIENCE IN YEARS.

Meals	Men (years)	Women (years)
Total	2.65	3.60
Breakfast	.98	1.31
Dinner	3.81	5.05
Supper	3.14	4.46

The distribution of the instances by meals and by the sex of the purchasers is as follows:

TABLE II.

TABLE SHOWING NUMBER AND PERCENTAGE OF FOOD PURCHASERS BY MEALS.

Meals	Total		Men		Women	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	6,843	100.0	2,897	100.0	3,946	100.0
Breakfast	836	12.2	359	12.4	477	12.1
Dinner	3,233	47.3	1,391	48.0	1,842	46.7
Supper	2,774	40.5	1,147	39.6	1,627	41.2

The following table shows for the men and the women both the number of purchasers and the average expenditure per meal as well as the ratio of the average amount expended by women to that expended by men:

TABLE III.

TABLE SHOWING BY MEALS THE NUMBER OF PURCHASERS OF FOOD, THE AVERAGE EXPENDITURE AND THE RATIO OF EXPENDITURE, BY MEN AND WOMEN.

Meals	Total		Men		Women		Ratio of Expenditures—Women to Men
	Number	Average Expenditure (cents)	Number	Average Expenditure (cents)	Number	Average Expenditure (cents)	
Total	6,843	35	2,897	38	3,946	33	86.8
Breakfast	836	21	359	23	477	19	82.6
Dinner	3,233	35	1,391	38	1,842	32	84.2
Supper	2,774	39	1,147	42	1,627	37	88.1

The table above shows that the average expenditure for both men and women for the 6,843 meals was 35 cents, and that the ratio of the average expenditure for all of the meals was 86.8 to 100.0 for women and men. It is interesting to note that the ratio increases with the amount of the expenditure.

The following table classifies the expenditures in the same manner as Table III, but shows the days of the week separately:

TABLE IV.

TABLE SHOWING BY DAYS OF THE WEEK, THE NUMBER OF PURCHASERS OF FOOD, THE AVERAGE EXPENDITURE AND THE RATIO OF EXPENDITURES BY MEN AND WOMEN.

Days	Total		Men		Women		Ratio of Expenditures—Women to Men
	Number	Average Expenditure (cents)	Number	Average Expenditure (cents)	Number	Average Expenditure (cents)	
Total........	6,843	35	2,897	38	3,946	33	86.8
Sunday (b)...	753	43	335	47	418	40	85.1
Monday (a)..	922	35	399	38	523	33	86.8
Tuesday.....	1,080	34	449	37	631	31	83.8
Wednesday ..	985	33	429	36	556	31	86.1
Thursday....	1,122	33	481	34	641	32	94.1
Friday.......	1,091	34	453	37	638	33	89.2
Saturday	890	35	351	39	539	33	84.6

The ratios vary from 83.8, as a minimum, to 94.1, as a maximum, with 86.8 as the average. By classifying the days, the meals and the sexes of the purchasers the following ratios of expenditures by women and men are secured:

TABLE V.

TABLE SHOWING BY DAYS OF THE WEEK AND BY MEALS THE RATIOS OF EXPENDITURES FOR FOOD BY MEN AND WOMEN.

Days	Ratios of Expenditures—Women to Men		
	Breakfast	Dinner	Supper
Sunday...........................	83.3	90.7	(b)
Monday...........................	(a)	85.3	88.1
Tuesday...........................	82.6	82.9	88.1
Wednesday.........................	100.0	82.4	90.5
Thursday..........................	81.0	87.9	90.5
Friday............................	90.5	83.3	92.9
Saturday..........................	79.2	86.1	81.8

(a) No breakfasts.

(b) No suppers.

While the above comparisons are made on the basis of the average (arithmetic mean) expenditure, the same general relations are found to hold when the medians and quartiles of the respective groups are compared. In the table below, these ratios are set out in detail:

TABLE VI.

TABLE SHOWING THE RATIOS OF EXPENDITURES FOR FOOD BY MEN AND WOMEN BASED ON THE ARITHMETIC MEANS, THE MEDIANS AND THE QUARTILES.

Meals	Ratios of Expenditures for Food, Women to Men, based on			
	Arithmetic Means	Medians	First Quartiles	Third Quartiles
Total	86.8	81.6	85.2	89.5
Breakfast	82.6	86.4	88.2	82.1
Dinner	84.2	81.1	82.1	87.2
Supper	88.1	88.6	84.9	90.4

The ratios are noticeably stable for the different averages, varying for all meals from 81.6, as a minimum, in the case of the median, to 89.5 as a maximum, in the case of the third quartile. For the individual meals, dinner, on the basis of the median, with a ratio of 81.1, has the lowest ratio, and supper, on the basis of the third quartile, with a ratio of 90.4, has the highest ratio. Of course, this is only another way of saying that the distributions in the expenditure series for men and women have the same general conformation, the difference of approximately 14 per cent. being constant for the averages taken. Other summary expressions, as for instance, the decils, would reveal the same general relationship.

The actual expenditures by five-cent groups for the sexes and the meals separately are given in the following frequency table.

TABLE VII.

TABLE SHOWING THE EXPENDITURES FOR FOOD BY MEN AND WOMEN AND BY MEALS.

Expenditure Groups (cents)	Meals and Purchasers of Food											
	Total			Breakfast			Dinner			Supper		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total.....	6,843	2,897	3,946	836	359	477	3,233	1,391	1,842	2,774	1,147	1,627
3 to 7 ..	15	7	8	5	1	4	6	2	4	4	4	—
8 to 12 ..	188	64	124	84	25	59	57	12	45	47	27	20
13 to 17 ..	516	150	366	252	91	161	183	39	144	81	20	61
18 to 22 ..	763	230	533	220	87	133	356	98	258	187	45	142
23 to 27 ..	982	343	639	134	65	69	552	186	366	296	92	204
28 to 32 ..	849	345	504	70	42	28	497	211	286	282	92	190
33 to 37 ..	672	315	357	34	25	9	350	179	171	288	111	177
38 to 42 ..	758	334	424	19	11	8	336	174	162	403	149	254
43 to 47 ..	702	351	351	14	12	2	297	164	133	391	175	216
48 to 52 ..	563	307	256	2	—	2	224	120	104	337	187	150
53 to 57 ..	407	223	184	1	—	1	159	89	70	247	134	113
58 to 62 ..	179	106	73	—	—	—	77	47	30	102	59	43
63 to 67 ..	100	49	51	—	—	—	60	29	31	40	20	20
68 to 72 ..	75	37	38	—	—	—	38	23	15	37	14	23
73 to 77 ..	36	16	20	—	—	—	18	7	11	18	9	9
78 to 82 ..	17	11	6	—	—	—	9	5	4	8	6	2
83 and over	21	9	12	1	—	1	14	6	8	6	3	3

ON FUNCTIONAL RELATIONS FOR WHICH THE COEFFICIENT OF CORRELATION IS ZERO.

BY H. L. RIETZ, *University of Iowa.*

The recent papers of Reed* and Harris in these Publications have brought to my mind some simple cases in which a correlation coefficient is zero although the two variables are mathematical functions of each other represented by certain simple types of continuous curves.

Those who have studied critically the theory of correlation are perhaps aware of the limitations of this valuable theory as well as they are aware of its useful applications. But those who are making applications without fundamental knowledge of the method are apt to overlook the limitations in applying a summary method of quantitative description such as is provided by the correlation coefficient.

The following rather striking illustration should serve to make clear a limitation on the generality of the correlation coefficient as a measure of correlation. Suppose we had observed as corresponding variates the coordinates x and y in a simple harmonic motion given by

$$y=\cos \lambda x \qquad (1)$$

in the interval from $x=0$ to $x=\frac{2\pi}{\lambda}$.

That is to say, let us consider the case in which we have given the corresponding values of x and y in (1) for a set of n x's in the interval from 0 to $\frac{2\pi}{\lambda}$. Let x_t and y_t $(t=1, 2, 3, \ldots, n)$ be corresponding variates; $\bar{x}$ and $\bar{y}$ the mean values of x's and y's respectively; and σ_x and σ_y the standard deviations. Assume further that the points (x_t, y_t) are symmetrical about the middle point of the interval, so that $\bar{x}=\frac{\pi}{\lambda}$. Then $\bar{y}=0$. Furthermore, it is clear from symmetry of points about $(\bar{x}, \bar{y})$ that the correlation coefficient

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* Reed, Vol. 15, pp. 670–684, 1917; Harris, J. Arthur, *loc. cit.*, pp. 803–805.

$$r=\frac{\sum\limits_{t=1}^{t=n}(x_t-\bar{x})(y_t-\bar{y})}{n\sigma_x\sigma_y}=\frac{\sum\limits_{t=1}^{t=n}\left(x_t-\frac{\pi}{\lambda}\right)(y_t-0)}{n\sigma_x\sigma_y}=0 \qquad (2)$$

Similarly, if we deal with a continuous distribution of points along the curve $y=\cos\lambda x$ where kdx (k constant) is the frequency of values in the interval dx, we have

$$r=\frac{k}{s^2}\int_0^{\frac{2\pi}{\lambda}} y\left(x-\frac{\pi}{\lambda}\right)dx,$$

where s^2 is the geometrical mean of the second moments of the distribution about the two lines $x=\frac{\pi}{\lambda}$, and $y=0$. That is to say, we obtain a correlation coefficient $r=0$ for a case where the relationship is given by the function $y=\cos\lambda x$.

If the points were distributed uniformly with respect to intervals Δx in a thin band along the curve $y=\cos\lambda x$ instead of being exactly on the curve, r would be nearly zero.

These results do not at all constitute a reflection on the use of the correlation coefficient for many purposes, but they do show that it is improper to infer that no correlation* exists because r is equal to or nearly zero.

West† states that "if the regression curve is of a certain shape the value of r will be very small even though practically perfect correlation exists." It is clear from the above illustration that it would be justifiable to strengthen this statement by saying that if the regression curve is of a certain shape the value of r would be zero in certain cases even when the one variable is a certain trigonometric function of the other.

Instead of the distribution given by $y=\cos\lambda x$, we may take the more general case $y=f(x)$ in the interval $-a$ to a where $f(x)$ is a single valued function symmetrical about the line $y=0$. When the distribution of the points in equal intervals Δx is uniform in the sense prescribed above for $y=\cos\lambda x$, we obtain for $y=f(x)$ also the result $r=0$.

* Cf. Yule, Proc. of Royal Society, Vol. 60, p. 477, 1897.

† Introduction to Mathematical Statistics, pp. 84–85.

For values of x in the interval $-a$ to a, a class of functions for which $r=0$ is given by $y=f(x)$ subject to the condition

$$\int_{-a}^{+a} xy\,dx=0.$$

Hence, it is simply the first moment about the y-axis of areas bounded by $y=f(x)$, the x-axis, and ordinates $x=-a$ and $x=a$ that must vanish. This condition is satisfied by a variety of simple functions.

Harris holds that Reed put too much emphasis on the importance of testing the linearity of regression in the early stages of a correlation study. With this position taken by Harris, the writer is in agreement if the question is one merely of showing the existence of correlation rather than one of showing the degree of correlation; for, if regression is not linear, the value of r turns out to be smaller than the correlation ratio—a function appropriate to describe correlation without a limitation of linear regression. That is to say, the use of r does not lead us to infer a greater degree of correlation than exists, but in cases of non-linear regression it may lead us to infer a smaller degree of correlation than exists.

The interpretation of the significance of differences between two correlation coefficients cannot go far until careful inquiry is made into the form of the regression curve. The prediction of the mean value of y that corresponds to an assigned value of x is likely to be valuable only when the form of the regression curve is known.

Let us consider next the application of the correlation ratio instead of the correlation coefficient to a distribution of points given by a single valued function such a $y=\cos \lambda x$. By definition, the correlation ratio of y on x is

$$\eta_y=\frac{\sigma_{\bar{y}_a}}{\sigma_y},$$

where $\sigma_{\bar{y}_a}$ is the standard deviation of the means of arrays of y's that correspond to equal assigned intervals Δx of the variable x, when the square of the deviation $\bar{y}_x-\bar{y}$ of the mean $\bar{y}_x$ of any array from the mean of the total population $\bar{y}$ is weighted with n_x, the number in the array.

Consider the case of a set of n points on the curve $y=\cos\lambda x$ distributed so that the same number of points are found in equal intervals Δx. When each Δx is decreased so as to contain only one point, it is clear that

$$\eta_y=1.$$

Similarly, when we assume a uniform continuous distribution of points such that kdx (k constant) gives the frequency for the interval dx, we have, when dx is decreased indefinitely,

$$\eta_y=1.$$

Thus, η_y is an appropriate measure of the dependence of y on x.

Let us find next the correlation ratio of x on y for the rather artificial and freakish case from a statistical standpoint of looking upon x as a function of y for the distribution of sets of points described above. Thus,

$$x=\frac{1}{\lambda}\text{ arc cos }y$$

is a two valued function of y in the interval $y=-1$ to 1, when x is restricted to the interval 0 to $\frac{2\pi}{\lambda}$. If we construct arrays of x's that fall into intervals dy, it is obvious from symmetry that $x=\frac{\pi}{\lambda}$ is the line of regression—all the means falling exactly on this line. But for the entire distribution, $\bar{x}=\frac{\pi}{\lambda}$. Hence, it is clear that the correlation ratio of x on y gives

$$\eta_x=0.$$

Thus, $\eta_x=0$ although x is a certain well known double valued mathematical function of y. Such an extreme case seems to be of value only in showing the logical character of the correlation ratio.

But $\eta_x=0$ does even in this case give the correct summary result in answer to the question as to the extent to which mean values of x tend to arrange themselves along a *single* curve, known as the curve of regression of x's on y. But this question and answer are of little or no value when instead of an arrangement along a single curve, we have arrangements of points along two curves as cited in the illustration. The main point to be kept in mind in this connection is that the correlation ratio gives a summary description of the deviations of the points from a single valued function.

NEW MEMBERS OF THE ASSOCIATION, ELECTED JANUARY TO JUNE 1919.

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NOMINATING COMMITTEE FOR ANNUAL ELECTION OF OFFICERS, 1919

In accordance with Section IX of the Constitution, which requires the personnel of the Nominating Committee to be published in the QUARTERLY three months before the annual meeting, the President has appointed the following:

W. C. MITCHELL, *Chairman.*
E. A. GOLDENWEISER.
W. S. ROSSITER.

REVIEWS AND NOTES.

The Review of Economic Statistics, Preliminary Volume, Number 1, January, 1919. Harvard University Press.

Harvard University in the spring of 1917 appointed a Committee on Economic Research. An article by the chairman of this committee, Professor C. J. Bullock, printed nearly two years earlier* and doubtless one of the influences leading to the establishment of this committee, pointed out that existing provisions for economic research, confined as they are to the individual investigator and governmental agencies, are entirely inadequate. The large and increasing mass of material flowing from government sources needs careful verification and interpretation before it can be made useful. This interpretation is seldom well made by the government because in many of these fields political or social implications tie the hands of the official, color his vision of the meaning of his results, or limit him to severely practical and obvious deductions. Endowments for research in this field are sorely needed and universities are the best agencies to administer them.

The Committee on Economic Research decided to make its initial effort in the field of economic statistics and this new serial, under the able editorship of Professor Warren M. Persons, is the result.

From the fact that the subscription price of the quarterly and its monthly supplements is $100 a year it may be fair to infer that the committee plans to make at least this part of its work approximately self-supporting. But the new serial without its supplements is also to be furnished gratuitously to a limited number of university libraries.

The object of the *Review* is apparently divisible into two parts, the ultimate and the immediate purpose. The ultimate purpose "is to promote the collection . . . and interpretation of economic statistics . . . for business and scientific purposes" (Prefatory Statement). The immediate purpose is to "deal chiefly with these industrial, commercial, and financial data which ordinarily serve as the basis for judgments concerning fundamental business conditions" (*Ibid.*).

These statements suggest certain questions, such as, What is the nature and scope of economic statistics? How, if at all, does economic statistics differ from business statistics? If business purposes and scientific purposes in one or both of these fields (in case they are not identical) lead in different directions how are the two sorts of purposes to be reconciled? But this preliminary number avoids the consideration of such questions by confining its attention to the immediate purpose. We may hope that in the future the *Review of Economic Statistics* will give some share of its attention to questions of the sort just mentioned which grow naturally out of its ultimate purpose.

What of the contents of the first number of this preliminary volume?

"Perhaps the most important service rendered by such journals as the *Commercial and Financial Chronicle, Bradstreet's,* the *Iron Age* and the

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*Harvard Graduate's Magazine, 23: (1914–15), 601–610.

New York Journal of Commerce is to collect and publish regularly statistical series with weekly or monthly items" (page 5). The government has given little attention to this important field. "None of the journals which collect and publish fundamental statistics apply any except the simplest and most obvious methods of analyzing the data presented" (*Ibid.*). Errors and discrepancies in the material are not infrequent. The data included are usually representative rather than complete. To the task of analyzing and interpreting these important data very little attention has thus far been given and this is the immediate work to which the *Review of Economic Statistics* hopes to contribute.

This first issue is devoted exclusively to developing a method of handling these business statistics whereby the significance of each item as an index of current business conditions can be ascertained. Perhaps some notion of this method can best be conveyed by an example and for that purpose I have chosen the monthly figures for the production of pig iron in the United States. These figures, like the others studied, are assumed as a working hypothesis to be subject to (1) a long time tendency, in this case to an increase of output, (2) a seasonal variation within the year, (3) a cyclical movement depending upon the alternation of periods of business prosperity and depression, and (4) other residual variations. This hypothesis can be proved to be correct or incorrect in any case only by contriving methods of measuring the effects of these various influences and with their aid discovering whether each influence was or was not felt.

By previous testing it had been found that of the two methods used to measure a long time tendency, namely, the method of moving averages and the method of fitting a straight line or a curve to the data, the latter was the better. So by the method of moments a straight line was fitted to the series of figures showing the annual output of pig iron 1903–16. The result indicated an annual increment in the monthly output of 95,200 tons and opened the way for so correcting the figures as to eliminate this long time tendency or secular trend from the series.

The next problem was to discover whether there is any seasonal variation in the series of figures with the further purpose, if one is found, of measuring its magnitude and introducing the needed corrections. The difficulties in the way of allowing for the different lengths of the months, calendar or statistical, and for the proper treatment of Sundays led to a decision not to attempt separating these artificial differences from the real ones due to varying degrees of activity in equal periods of time.

To determine the presence or absence of seasonal variation the graphic method was tried. This did not reveal any general seasonal variation traceable in every year or even in a majority of the years but showed rather that the seasonal variation, if present at all, was masked by the cyclical movement between prosperity and depression. This method of studying seasonal changes by examining departures from the yearly average proving unsatisfactory, attention was directed to monthly changes measured in link relatives or percentages that one month's figures make of those of the preceding month. The distribution of these link relatives in any series usually shows a characteristic variation between two consecutive months with occasional wide departures obviously due to other influences upsetting the normal trend of change. The median is accepted as the best index of the characteristic variation between two consecutive months. By this method a measure of seasonal variation is obtained and the way is opened for estimating and eliminating the influence of these variations.

The remaining problems are to measure the influence of the alternate waves of prosperity and business depression and lastly the influence of irregular factors which occasionally interfere with or override one or more of the factors already analyzed. To the preliminary question whether there is a "law" of business cycles under which prosperity recurs at intervals defined by the recurrence of sun spots or of rainfall and other weather conditions favorable to good crops or by other causes, Professor Persons returns the answer "not proven." He finds it impracticable to separate the cyclical from the irregular fluctuations, although it is relatively easy to separate secular trend and seasonal variation from each other and from the cyclical and irregular fluctuations taken together.

The various series which thus far have been studied separately must next be compared and for that purpose some unit of each series is needed which will facilitate a comparison between the series. This need is met by recourse to the standard deviation.

At this point the discussion in the present issue comes to a close leaving for later numbers the development of a method of studying the relations of each series to the others and to general economic conditions and an examination of the question whether generalisations of the type described which have been derived from the past can be applied to the future.

The new periodical promises well and, I doubt not, will speedily make an important place for itself. If a distinction is to be recognised between economic statistics and business statistics, little in the first number indicates that the new review will devote itself to the former rather than the latter field. Nor does the word "Review" in the title seem entirely satisfactory because that word both by derivation and by usage implies that much attention will be given to evaluating the work of others. Archives or Repository or Bulletin or Contributions seems to describe more accurately than Review the probable content of the new serial. May I enter a mild protest also on behalf of the librarians. The size of the new publication, 11 by 16 inches, makes it awkward to house on shelves with other economic literature. In 1853, I believe, the American representative to the first International Statistical Congress came back with the report that he met with constant protests against the inconvenient size of the American census volumes and since that date they have uniformly appeared as quartos. No one today would think of increasing their size and much might be said for reducing it. The charts in the present issue might be divided or folded in or reduced so that a hand glass would be needed to read them. In my opinion the series would be much more serviceable if it should be reduced to a smaller page.

Cornell University. WALTER F. WILLCOX.

The War with Germany: a Statistical Summary. By Leonard P. Ayres, Colonel, General Staff. Washington: Government Printing Office, 1919. Pp. 154.

From early times the conditions of warfare have led to a recognition of the importance of quantitative values. The battle of Thermopylae is remembered chiefly because of a notable disparity in the numerical strength of the forces engaged. Collecting and preserving statistical facts is a routine function of military organizations, and the records of modern wars contain more or less information concerning the men and officers who served, casualties, prisoners taken, artillery and small arms employed, and supplies consumed.

Considered from the statistician's standpoint, the war against Germany differed from earlier conflicts, first, in the volume and diversity of the items of information assembled and, second, in the fact that the recording and collating of much of this material was recognized as a statistical task and was intrusted to skilled and experienced statisticians. The report prepared by Colonel Ayres is the first important publication, at least in the United States, in which statistical methods have been consciously applied to the administrative phases of the war.

The scope of the report is shown by the following condensed list of subjects: Men drafted; period of training; transportation of troops; production and transportation of food, clothing, equipment, motors, aircraft, artillery, rifles, and revolvers; ground gained in battle; health and casualties, and international comparisons. The report is a War Department publication, dealing only with those portions of the war against Germany in which the United States was engaged, and only with those phases of American participation which came under the direction of the Secretary of War. The work of the Navy, while mentioned with appreciation, is not described, and that of the Marine Corps is only incidentally referred to. In his letter of authorization, the Secretary of War asks for a presentation of "significant facts and figures with respect to those major steps in our military preparation and action which, taken together, constitute the record of our participation in the war." Considered with reference to these instructions, the selection of topics seems admirable. No reference is made to routine functions of the War Department affecting personnel, such as the transmission of mail between men in service and their relatives, the reporting of casualties, and the payment of the troops, which have a direct bearing on the morale of the army and the civil population. In view of public interest in these subjects any statistics which could be compiled would have been acceptable.

In plan of treatment, the report is descriptive rather than analytical. It is addressed, primarily, not to students of statistics or of history, but to all intelligent readers who wish to be informed as to the facts of the war. Where comparisons are made their purpose is to lend emphasis to the description of conditions, rather than to connect cause with effect. The author has sought, above all, to make his presentation of facts clear and striking, and his efforts have been successful to an exceptional degree.

By the omission of details of information and descriptions of technical procedure, the report has been fitted to the requirements of the general audience to which it is primarily addressed. The condensation of statistical subject matter is a difficult task, but the data have been selected with skill. Only a few isolated instances have been noted in which the array of facts and figures appears incomplete, or the discussion insufficient.

The comparisons of the work and achievements of the different countries engaged in the war with Germany seem imperfectly descriptive because of the omission of essential factors. Thus, on page 14, there is a diagram comparing the numerical strength of the British and American armies in France during the period from 1914 to the signing of the armistice, and the statement is made that it took England three years to reach a strength of two million men, while the United States accomplished an equivalent result in one half that time. The fact that from the very outset of the war the English were forced to make good the effects of heavy casualties, and that the increase in their forces was in this way materially retarded, is referred to in the text, but it would have been well, in view of the overwhelming importance of this factor, to have based the comparison upon the numbers of men sent to France each month. Even after such a change in method, the data would have but superficial significance by reason of the difference in the populations and resources of the two nations and the disproportionate demands made upon the British by the requirements of their navy, which contributed so largely to the final victory, the operation of their merchant marine, and the maintenance of armed forces in Mesopotamia, Egypt, Palestine and the Balkans. A like criticism applies to most of the material presented in the final pages of the report under the heading "International Comparisons," for here again armies and armaments are compared without reference to the population and wealth of the different countries. While statistician or student of international affairs can readily sense the lack in these statistics and will be protected by his knowledge from erroneous conclusions, to many readers of the report the incomplete comparisons may be actually misleading. It is true that the author is not attempting analysis, but the passages referred to are not satisfactory as description, for the presentation of all significant facts is the first essential of description.

In the chapter entitled "Health and Casualties," which is the most analytical of the report, the difficulties of condensed presentation are most apparent. This chapter begins with a comparison of fatalities per 1,000 men in different armies and in different wars. As no reference is made to the duration of the periods during which the armies were employed nor to the intensity of the fighting, it is not surprising that, in the war with Germany, the losses of foreign armies greatly exceeded those of the American army, and that the loss sustained by the American army in this war fell short of those of the North in the American Civil War. Total losses, without reference to the duration of the fighting, clearly have a marked social and economic significance; but in this connection losses should be related to total population rather than to military forces.

On page 124 of this same chapter the losses of the American armies per 1,000 men in different wars are compared on an annual basis. This procedure is clearly correct, but the statement is made, in the discussion of the figures, that the losses in the European war were "higher than in the Civil War because all of the fighting was concentrated in one year, while in the Civil War it stretched over four years." It is evident that the effect of the length of the period during which the armies were employed is allowed for by placing the rates upon an annual basis.

The discussion of the control of disease suggests the advisability of a further analysis of the statistical material. From the diagram on page 124, already referred to, it appears that the death rate from disease among American troops was 26 per 1,000, on an annual basis, in the Spanish War, and but 19 per cent. 1,000 in the war with Germany. It is further reported, however, that of the deaths from disease in the earlier war 85 per cent. were caused by typhoid fever, as compared with only one half of one per cent. in the recent war, and the application of these percentages to the reported death rates from disease shows that the rate per 1,000 from disease other than typhoid was 18.9 (19 x [1.000 – .005]) in the war with Germany, as compared with 3.9 (26 x [1.00—.85]) for the Spanish War. It is true that, in the war with Germany, pneumonia, resulting in a large measure from the influenza epidemic which presumably could not have been foreseen nor prevented by the army authorities, caused 83.6 per cent. of all the deaths from disease, the death rate from all diseases other than pneumonia and typhoid being 3.02 per 1,000, a figure lower than that for diseases other than typhoid cited above for the war with Spain. However, deaths from pneumonia doubtless occurred in the Spanish War, contributing to the rate of 3.9, and the pneumonia deaths of the war with Germany cannot all have been the result of influenza—indeed, the report states (page 126) that measles were prevalent during the first of the war and "particularly dangerous as the predecessor of pneumonia." It seems to follow that, except for the elimination of typhoid as an important cause of fatalities, the death rate from diseases may not have been appreciably lower in the war with Germany than in the war with Spain. But the reviewer's analysis is too tentative in character to serve as a basis of conclusions; it is presented as a means of directing attention to the need for a further study of the records.

The clearness and effectiveness of presentation which characterize the report have been achieved, in a large measure, through the employment of seventy-two diagrams and twelve maps. The text discussion is built on and about the diagrams, the tabular statements employed being brief and incidental. In a report dealing, as this one does, with a wide range of subjects, and intended for a popular audience, a long series of diagrams identical in plan would be monotonous. The economy of mental effort resulting from similarity of form is less important than the stimulation of the attention to be obtained through variety. In employing a large number of different graphical types, the author has applied with fidelity the fundamental rule of graphical presentation which prescribes the inclusion of the zero line. The procedure followed throughout the report of placing figures at the ends of bars of varying length and inserting figures in bars and columns may be open to question from the standpoint of optical effect, but it does not seem that the results are in any case misleading. The presentation of figures upon which graphical representations are based constitutes sound and useful practice. With the exception of those on pages 41 and 42, which fall well below the prevailing standard of execution, the statistical maps are admirable.

The report is, a successful venture in the field of statistical journalism; to quantitative subject matter of current interest the author has imparted proportion and vividness. He has done much in addition to this. Without attempting a complete mapping of the statistical territory created by the war, he has established landmarks which will be of great value to workers concerned with the details of special problems. He has produced, also, a convenient and readable handbook which, as a source of authoritative and definite information about some of the central facts of American participation in the war, will be useful for an indefinite period.

EARLE CLARK.

STATISTICS OF THE INFLUENZA EPIDEMIC.

The subject of statistical study of the influenza epidemic was brought up at a special meeting of this Association held March 28, 1919, at the City Club, New York City. A speaker representing the Vital Statistics Section of the American Public Health Association outlined what had been accomplished by a committee of that organization in planning statistical studies of American influenza data. The speaker indicated the bearing upon modern statistical practice of what had been done for the data of the epidemic of thirty years ago, quoting Leichenstern* as to the contributions which the statistical profession had made to the history of influenza.

"Epidemiologic investigation is much indebted to modern statistics for its progress, to the high development of medical journalism, and to the powers that have been universally brought to bear toward achieving collective investigations and scientific researches."

The German Collective Investigation by Geyder and Guttmann; the exhaustive reports by Parsons (1889–1892); the French Academy report by Proust-Brouardel, and the army report of Kelsch and Antony; the Russian report by Teissier; the Belgian "*enquête sur l'epidémie de grippe*"; the Dutch report of Solomonson and de Rooj; the Danish report by Carlsen; the Swedish by Linroth; the Egyptian by Engel-Bey; as well as the investigation by Abbott (Massachusetts), and for Riga, Cologne and Danzig, were mentioned as types of statistical inquiries providing the pattern for researches into the recent epidemic.

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* "Nothnagel's Encyclopedia of Practical Medicine," Saunders, Phila., 1905.

Some statisticians have expressed a doubt that the disease known as "influenza" today is the same disease observed by the collective investigations of thirty or more years ago. A survey of the literature on influenza for the past one hundred years indicates, however, that this doubt has been expressed at the time of each epidemic. In fact, no introduction to a collection of influenza statistics seems to have been complete, in times past, without some sort of observation of this kind.

Continuing, the speaker held that there were, in general, two approaches to the mystery of influenza, the one, an *intensive* inquiry into the clinical, particular aspects of the disease; the other, an *extensive*, statistical collection of facts. It is the function of the statistician to supplement the facts and conclusions of the intensive case-worker, with the broader conclusions drawn from a survey of various groups in the communities affected by the epidemic.

Work upon plans for the statistical, or extensive, study of the epidemic in American communities was begun by the Vital Statistics Section of the American Public Health Association, on November 20, 1918, by the appointment of an emergency committee which met on November 29 and 30, 1918, at the Hygiene Laboratory, University of Pennsylvania, Philadelphia, Pa. The aim of this committee was to secure from the registrars and public health statisticians of the eastern states, a statement of minimum requirements in a programme of statistical study of the epidemic. This programme was submitted to the Vital Statistics Section at its meeting in Chicago on December 11, at which time the recommendations of the committee were considered, and the committee empowered to continue its work.* Further notes on this committee's proceedings are to be found in the March, 1919, QUARTERLY PUBLICATIONS OF THE AMERICAN STATISTICAL ASSOCIATION and in the February, 1919, number of the *American Journal of Public Health*. The remarks of the speaker representing this committee closed with a request that the American Statistical Association lend its encouragement to the thorough statistical study of the epidemic. Only through such collection of materials would there be available a body of epidemiologic data of value in determining the causes, extent, and other characters of the recent epidemic, and the control of future visitations of the disease. Special emphasis was placed upon the need for methods of higher analytic description of the disease—methods developed by the English biometricians and by the French and Scandanavian mathematicians. A suggestion was also made that the epidemic be studied mathematically as a phenomenon in bio-chemistry, making use of the theories of measurement in that science as advocated by Professor Svante Arrhenius and others of the Stockholm School.

President Hill appointed a committee to prepare a resolution which is given below. The members of the American Statistical Association present at the meeting endorsed this resolution in substance.

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*"Influenza Bulletin," *Amer. Public Health Association*, Boston, Mass., Dec. 13, 1918.

RESOLUTION.

Whereas, The prevention of future catastrophic invasions of influenzal disease depends in part upon the conclusions which will follow a thorough statistical study of the epidemic and,

Whereas, The advances in statistical and mathematical science in recent years have made it possible to determine more readily the nature, probable causes, extent and perhaps the methods of control of such epidemics, in relation to climate, habitat, race, economic status, and other aspects of the life of mankind,

Therefore Be It Resolved, That the American Statistical Association, at its special meeting held in New York City, March 28, 1919, endorses the work begun by the American Public Health Association, and by other bodies associated with it, in outlining programmes for the tabulation and analysis of influenza statistics by municipal, state, federal and private organizations,

Furthermore Be It Resolved, That the Association urges qualified statisticians of its membership and in statistical societies elsewhere to apply every technical resource of modern statistical science in the study and interpretation of the published influenza data.

Committee on Resolutions:
G. H. VAN BUREN,
F. S. CRUM,
E. W. KOPF (Chairman).

ANENT THE NEW AND THE OLD IMMIGRATION.

Mr. Paul H. Douglas in the June issue of the QUARTERLY has undertaken to answer the question, "Is the new immigration more unskilled than the old?"

"It is commonly stated," he says, "that the newer immigration from Southeastern Europe is more unskilled than the older immigration from Northwestern Europe. This has been challenged by a few writers, *but it has not by any means been effectually refuted*."

He therefore proceeds to compare the statistics of the old and the new immigration and comes to the conclusion that all the change amounts to is that "the unskilled laborers from the Southeast have displaced the unskilled laborers from the Northwest."

"If this long accepted belief in the higher percentage of skilled workers among the old immigration is, after all, erroneous, why has it been cherished for so long?" inquires Mr. Douglas. And he answers that, among other causes, it is due to "the custom of each generation to view the immigrants of its days as inferior to the stock that once came over."

These are precisely the conclusions which I have reached in my book "Immigration and Labor," referred to by Mr. Douglas. I am chagrined to learn from his article that "impartial students" have been led "to discredit the value of his (my) conclusions." Perhaps the methods by which

Mr. Douglas has arrived at his conclusions differ from those used by me? On pp. 67, 68 cited by Mr. Douglas there are two statistical tables in which the occupations of the immigrants are compared for the half-century, 1861–1910, by decennial periods. It appears that skilled workers constituted 24 per cent. in 1861–1870, 23.1 per cent. in 1871–1880, and a fraction over 20 per cent. from 1881 to 1910, whereas unskilled laborers and farm help combined constituted between 51 per cent. and 57.9 per cent. of all immigrants with occupations.

Mr. Douglas, on the other hand, confined himself to two periods within the same half-century, viz., 1871–1882 and 1899–1909, and found that "skilled workers comprised 22.9 per cent. of the immigrants from the countries from Northwestern Europe, 18.1 per cent. of those from Southeastern." But he considers the difference "not decisive."

Mr. Douglas' discovery encourages me to hope that if other "impartial students" will with the same painstaking efforts recompute some of the statistical tables contained in my book they may concur in his statement that "some of the prejudice against the newer races has not been wholly absent from some of the writings upon American immigration problems."

Isaac A. Hourwich.

RESOLUTION OF THE CASUALTY ACTUARIAL AND STATISTICAL SOCIETY OF AMERICA

At a meeting of this Society, held in New York City, May 23, 1919, the following resolution drawn by a special committee appointed by the President of the Society, upon recommendation of the regular Committee on 1920 Census, was unanimously adopted:

Whereas: The published results of the forthcoming Census of population, of manufactures, mines, quarries and forestry in the United States, as authorized by the bill enabling the Fourteenth and Subsequent Censuses, will materially advance casualty insurance science, and will help especially to solve numerous rate-making and administrative problems in that science.

Therefore be it unanimously resolved by the Casualty Actuarial and Statistical Society of America that—

1. The statistics of classified wages in the Census of manufactures, mines, quarries and forestry be tabulated to show for the principal industries in the several states the number of employees by one-dollar weekly-wage groups up to thirty-five dollars, and by five-dollar wage-groups thereafter.

2. The statistics of the occupations of the population be classified and tabulated to show in principal states the number of persons in the important specific occupation classes of each significant industry of each State.

3. The classification of "external causes" of death in the International List of Causes of Death, Second Decennial Revision, 1909, be amended to show, in its application to the annual statistics of mortality in the Regis-

tration Area for Deaths, the number of accidental deaths due to (a) domestic hazard, (b) industrial or occupational hazard, (c) public liability hazard and (d) unknown or unspecified hazard, and that such deaths be tabulated by sex and age classes.

4. The statistics of diseases and accidents under treatment in a representative number of hospitals or other institutions be collected by the United States Public Health Service in accordance with an approved, uniform nomenclature and classification of such 'diseases and accidents, and through voluntary coöperative arrangement between the United States Public Health Service and the several hospitals or other reporting institutions. It is recommended that workmen's compensation and occupational disease cases under treatment be so specified, and the data shown for sex, age, duration of disability and for other items which are in the opinion of the United States Public Health Service of sufficient economic and social importance to warrant tabulation and publication. It is suggested, furthermore, that the data for injuries show not only the means of injury, but also the nature of the injury, *i. e.*, fractures by parts affected, various classes of wounds, infections following injury, etc.

Furthermore be it resolved: That a copy of this resolution be sent to the Director of the Census, to the Surgeon General of the United States Public Health Service, to the Chairman of the Census Committees of the House of Representatives and of the Senate.

CASUALTY ACTUARIAL AND STATISTICAL SOCIETY OF AMERICA.

Special Committee on Resolutions:

W. H. BURHOP (Chairman),
FREDERICK S. CRUM,
LEONARD D. HATCH,
GEORGE D. MOORE,
EDWIN W. KOPF.

NEW SERIES, No. 128. (VOL. XVI.) DECEMBER, 1919

QUARTERLY PUBLICATION OF THE
AMERICAN STATISTICAL ASSOCIATION.

I. TRENDS OF LONGEVITY IN THE UNITED STATES. BY C. H. FORSYTH.

II. DEPENDENTS OF COLLEGE TEACHERS. BY AMY HEWES.

III. AUTOMOBILE, MOTOR-TRUCK AND MOTOR-CYCLE STREET ACCIDENTS IN CHICAGO. BY HORACE SECRIST.

IV. CLASSIFICATION OF STATISTICAL SERIES. BY EDMUND E. DAY.

V. PRELIMINARY NOTE ON THE INCIDENCE OF EPIDEMIC INFLUENZA AMONG THE ACTIVELY TUBERCULOUS. BY RAYMOND PEARL.

VI. MEMBERSHIPS IN THE ASSOCIATION.

VII. NOMINATIONS FOR OFFICERS OF THE ASSOCIATION, 1919–1920.

VIII. AN APPEAL. BY RAYMOND PEARL.

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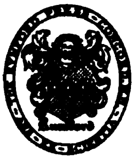

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AMERICAN
STATISTICAL ASSOCIATION

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TRENDS OF LONGEVITY IN THE UNITED STATES.

By C. H. Forsyth, *Dartmouth College.*

Every year the mortality statistics of about half of the states of this country covering many classes or groups of the population are collected and published by the federal government. This work has been carried on for about thirty years, although it has not always been on a yearly basis or involved so many states. Population statistics of a reliable character and for practically the same groups of all the states are collected each decade and this work has been carried on for about the same length of time, although much less satisfactory methods of taking the census date back as far as 1790.

In view of these statements it is very remarkable that so little is known about the relative health and longevity of the various groups of our population; for the information is available from mortality tables which could be constructed from the statistical data mentioned above.

The way in which the inhabitants of a community survive from year to year depends solely upon the values of the death rates at the various ages. If the values of these death rates are known—and they can certainly be determined from the statistical data collected by the federal government—they need only be applied successively to a hypothetical community of individuals all assumed to be of the same age—the earliest age under consideration—to show just how individuals will survive if those rates prevail in future years when the successive ages are attained. Now, such a column of death rates by ages and the results obtained by applying them to a hypothetical community constitute a mortality table. The American Experience Table constructed over seventy years ago from the records of life insurance companies and used by practically all the life insurance companies of this country is such a table.

Relatively few mortality tables which describe mortality conditions in this country have been constructed because of the immense labor involved in computing and applying the death rates corresponding to so many ages and sometimes in graduating or smoothing the results.

In the Registrar-General's Report (British) for 1914 was explained what promises to be a highly useful method or scheme of constructing abridged mortality tables or mortality tables wherein the results are found for only certain ages, say, each fifth age. Following such a scheme it is unnecessary to compute the results corresponding to the other ages and a vast amount of the computation otherwise necessary is eliminated. Furthermore, such abridged tables give practically all the information in regard to health at the various periods of life that the complete or unabridged tables would give.

The writer has adapted the scheme of computing abridged mortality tables to the case where the results are computed and given for only each *tenth* age and expects to publish shortly the necessary mathematical formulas in some mathematical journal.* The time required for constructing such a table after the statistical data are collected and arranged is very little over an hour.

The special purpose of this article is to give the most essential results taken from eighteen abridged mortality tables computed according to the scheme mentioned above. The mortality tables themselves are not given, because they would give practically no information not afforded by the tables of death rates and of expectations of life which are given below.

The statistical data used in the construction of the tables comprise the population and deaths for the three years, 1890, 1900 and 1910, of the seven states (Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont) which were the only states which were registration states *throughout* the two decades, 1890–1910, except for the year 1900 when the statistics for Vermont were necessarily omitted because of the faulty form in which the mortality statistics are published.

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*See the October (1919) issue of the Bulletin of the American Mathematical Society.

Although the statistical data used in this article, like all other ordinary statistical data, undoubtedly contain some more or less serious inaccuracies, and being based upon single years must reflect peculiarities of those years to the extent as to forbid placing too much confidence in the absolute results given below, the results of so many closely related tables check so well and vary from age to age so smoothly relatively that certain facts—a few of which will be pointed out—seem fairly well established. Furthermore, estimates of the longevity of the various groups considered are presented here—as far as the writer can find—for the first time.

DEATH RATES (per 10,000).

FOREIGN-BORN WHITE.

	Males					Females				
Age	1890	Diff.	1900	Diff.	1910	1890	Diff.	1900	Diff.	1910
10......	50	−13	37	−9	28	50	−35	25	+71	96
20......	73	−16	57	−9	48	64	−27	37	0	37
30......	94	−14	80	−20	60	62	+21	83	−23	60
40......	160	−39	121	−32	89	142	−23	119	−32	87
50......	232	−20	212	−20	192	198	−9	189	−36	153
60......	395	−18	377	+22	399	328	+31	359	−8	351
70......	661	+45	706	+87	793	616	+75	691	+85	776
80......	1368	+14	1382	+38	1420	1312	+214	1526	−184	1342
NATIVE WHITE—FOREIGN OR MIXED PARENTAGE.										
10......	53	−23	30	+2	32	11	+30	41	−13	28
20......	73	−11	62	−15	47	67	−10	57	−16	41
30......	139	−22	117	−12	105	110	−18	92	−16	76
40......	130	−2	128	+23	151	117	−19	98	0	98
50......	155	+3	158	+49	207	135	+7	142	+4	146
60......	286	−20	266	+91	357	241	−7	234	+36	270
70......	441	+46	487	+153	640	459	0	459	+120	579
80......	1155	−351	804	+608	1412	1266	−214	1052	+144	1196
NATIVE WHITE—NATIVE PARENTAGE.										
10......	45	−8	37	−6	31	41	−4	37	−6	31
20......	48	−3	45	+10	55	43	+4	47	−7	40
30......	63	+4	59	−12	47	57	−7	50	+3	53
40......	70	−3	67	−10	57	66	+4	70	−1	69
50......	92	+7	99	−7	92	96	+8	104	+4	108
60......	151	+25	176	+1	177	172	+26	198	+35	233
70......	297	+93	390	+18	408	338	+110	448	+36	484

The death rate varies so widely in the neighborhood of the year of birth and the necessary statistical data for that period are so lacking, that that period must be omitted in constructing abridged mortality tables.

EXPECTATION OF LIFE.

FOREIGN-BORN WHITE.

	Males					Females				
Age	1890	Diff.	1900	Diff.	1910	1890	Diff.	1900	Diff.	1910
10......	44.7	+1.7	46.4	+2.4	48.8	+47.2	+1.3	+48.5	−1.7	46.8
20......	37.2	+1.2	38.4	+2.1	40.5	39.8	+0.2	40.0	+1.9	41.9
30......	30.1	+0.7	30.8	+1.7	32.5	32.3	−0.3	32.0	+1.6	33.6
40......	23.4	+0.7	24.1	+0.5	24.6	25.0	−0.1	24.9	+0.8	25.7
50......	17.4	+0.2	17.6	−0.3	17.3	18.7	−0.6	18.1	+0.2	18.3
60......	12.0	−0.1	11.9	−0.6	11.3	12.9	−0.8	12.1	−0.2	11.9
70......	7.3	−0.2	7.1	−0.5	6.6	7.8	−0.5	7.2	−0.2	7.0
80......	3.3	−0.4	2.9	−0.4	2.5	3.6	−0.5	3.1	+0.1	3.2
NATIVE WHITE—FOREIGN OR MIXED PARENTAGE.										
10......	46.4	+2.1	48.5	−2.1	46.4	50.0	+0.5	50.5	+0.4	50.9
20......	39.3	+1.4	40.7	−2.4	38.3	41.7	+1.2	42.9	−0.4	42.5
30......	33.0	+0.9	33.9	−3.2	30.7	35.0	+0.7	35.7	−1.0	34.7
40......	27.4	+0.4	27.8	−3.3	24.5	28.8	+0.1	28.9	−1.5	27.4
50......	21.0	+0.4	21.4	−3.3	18.1	22.1	−0.1	22.0	−1.7	20.3
60......	14.8	+0.4	15.2	−2.8	12.4	15.6	−0.1	15.5	−1.8	13.7
70......	9.3	+0.6	9.9	−2.5	7.4	10.0	−0.4	9.6	−1.3	8.3
80......	4.8	+0.3	5.1	−1.8	3.3	6.9	−1.7	5.2	−1.3	3.9
NATIVE WHITE—NATIVE PARENTAGE.										
10......	56.1	−1.1	55.0	−0.9	54.1	57.6	−1.9	55.7	−0.1	55.6
20......	48.3	−1.2	47.1	−1.2	45.9	50.1	−2.3	47.8	−0.2	47.6
30......	40.5	−1.3	39.2	−1.4	37.8	42.6	−2.5	40.1	−0.1	40.0
40......	32.8	−1.5	31.3	−1.4	29.9	35.3	−2.8	32.5	−0.6	31.9
50......	25.1	−1.4	23.7	−1.5	22.2	27.9	−3.1	24.8	−0.9	23.9
60......	17.9	−1.3	16.6	−1.4	15.2	20.7	−3.1	17.6	−1.1	16.5
70......	11.5	−0.7	10.8	−1.4	9.4	14.5	−2.6	11.9	−1.7	10.2

Columns of death rates serve to point out the critical ages or ages at which a retrogression (or gain) begins or ends and so are fundamental when causes for a particular situation are sought. On the other hand, columns of expectations of life serve to show the way in which the effects of a particular situation are distributed throughout periods of life, some of which contribute nothing toward the particular situation.

Since, technically speaking, we are interested primarily in the total effects or results and not in the causes, the only comment we shall make upon the death rates is to point out the decided improvement from decade to decade at the earlier ages made by all three groups—both sexes—and the decided tendency to retrogress—especially natives of foreign or mixed parentage—at the higher ages. However, close examination of the relative values of the death rates will disclose considerable information to those sufficiently interested.

The columns of expectations of life are especially illuminating. Thus, both of the groups, foreign-born and natives of foreign or mixed parentage, seem to have an average expectation of life of about forty-eight years at age ten (with the males as the favored sex in the former group and the females as the decidedly favored sex in the latter group), and since the average duration of life usually differs little from the expectation of life at age ten we have here a fairly good estimate of the average duration of life for these groups.

The foreign-born whites, however,—especially the males—seem to have gained in the average duration of life in spite of losses in expectation at the higher ages while the natives of foreign or mixed parentage show a total heavy loss at practically all ages for the two decades. The males of the latter group showed some improvement at all ages in the decade 1890–1900 but suffered a tremendous retrogression in the decade 1900–1910. The females of the same group also present a very bad record. The observing reader will probably wonder at this time what factors in the American mode of living have contributed most to this momentous retrogression.

Too much emphasis can not be given to the facts and tendencies shown by the expectations of life of native Americans whose parents were also native, the group which calls naturally for most of our attention. Two facts stand out clearly: (1) native Americans of native parentage enjoy remarkable longevity (the average duration of life of this group exceeds that of any of the other groups by five to ten years in any year); (2) they are gradually losing this heritage at a rate of about one year per decade. There may, possibly, be cases where a longer longevity is enjoyed by natives of other countries (such as say New Zealand or Sweden) but such examples are few—there may be none. The writer knows of no statistical evidence of such longevity being enjoyed anywhere else on earth.

The question naturally arises: Could native Americans of native parentage—once they become familiar through proper propaganda with the knowledge of their wonderful heritage and the eminent possibilities of losing it—attain and maintain by conscious effort the longevity enjoyed twenty years ago?

The retrogression in longevity of native Americans of native parentage is not spasmodic as it is at some age-periods in the cases of the other two groups; the retrogression is definite and consistent and exists at every age in each decade and for both sexes. The retrogression among the males seems to be evenly distributed throughout the two decades, but the retrogression among the females seems to be confined mainly to the first decade giving some indication that the gentler sex has sized up the situation enough to cause them to face about. As a general rule females enjoy a greater longevity the civilized world over; it will be interesting to see what the statistical data of 1920 will disclose.

DEATH RATES—GENERAL POPULATION.

	Males					Females				
Age	1890	Diff.	1900	Diff.	1910	1890	Diff.	1900	Diff.	1910
12......	33	−5	28	−4	24	38	−9	29	−7	22
22......	86	−16	70	−14	56	75	−8	67	−17	50
32......	107	−20	87	−10	77	99	−15	84	−17	67
42......	136	−21	115	0	115	120	−17	103	−13	90
52......	196	−30	166	+15	181	171	−10	161	−11	150
62......	328	+5	333	+31	364	285	+11	296	+ 8	304
72......	617	+88	705	+59	764	564	+93	657	+30	687
82......	1389	+197	1586	−63	1523	1261	+111	1372	+46	1418

EXPECTATION OF LIFE—GENERAL POPULATION.

12......	46.3	+2.2	48.5	+0.6	49.1	47.9	+1.6	49.5	+1.8	51.3
22......	38.6	+1.9	40.5	+0.3	40.8	40.3	+1.2	41.5	+1.4	42.9
32......	32.1	+1.2	33.3	−0.2	33.1	33.6	+0.9	34.5	+0.6	35.1
42......	25.6	+0.6	26.2	−0.4	25.8	26.9	+0.4	27.3	+0.2	27.5
52......	19.3	0	19.3	−0.3	19.0	20.2	0	20.2	−0.1	20.1
62......	13.6	−0.6	13.0	−0.1	12.9	14.5	−0.7	13.8	−0.2	13.6
72......	8.5	−0.5	8.0	+0.3	8.3	9.2	−0.7	8.5	−0.1	8.4
82......	4.5	−0.1	4.4	+0.2	4.6	5.4	−0.6	4.8	+0.2	5.0

In conclusion, similar results computed by the same methods but on a quinquennial basis and therefore for different ages but based upon the *general population* (*i. e.*, including all the groups considered separately above) are quoted from a paper by the writer which appeared in *Science*, July 7, 1916. In that paper the statistical data comprised those used in this article plus those of the District of Columbia, except that Delaware was included in 1890 but excluded in 1900 and 1910, and Indiana, Maine and Michigan were included in 1900 and 1910. In comparing these results with those given above, the differences in the ages should also be noticed and taken into consideration.

The essential conclusions drawn in that paper (which are evident on examination of the tables) are that there was an average gain of a year and a half per decade in the average duration of life but *in spite* of considerable retrogression at higher ages. The results of that paper, though based on a slightly different population, serve, then, to summarize the results of this paper, giving approximately proper weight to the relative size of populations involved.

DEPENDENTS OF COLLEGE TEACHERS.*

BY AMY HEWES.

A new plan for determining retiring allowances for college teachers has been announced by the Carnegie Foundation for the Advancement of Teaching. This plan fixes for the retiring unmarried teacher and the teacher whose wife is not living an allowance which is only two-thirds of that to be received by the married teacher. For all classes the rates are fixed irrespective of whether the retiring teacher has or has had persons other than his wife dependent upon him.

The underlying assumption may be that the expenses of the unmarried teachers and the widowers are smaller, and therefore as large pensions are not required for their maintenance, or that they have had better opportunities to save. This feature of the plan has raised the question, which up to the present has received no satisfactory answer, whether the unmarried teachers and widowers are in fact in the economic position in which they are assumed to be.

It has been taken for granted, not only in the profession of teaching but in all professional life, that the unmarried persons in a community are on the whole free to spend their incomes for their individual requirements, while the married persons are the ones whose incomes must provide for others who are unable to earn, as well as for themselves. The information with which this assumption can be challenged has up to the present consisted almost wholly of instances, assumed to be exceptional cases, in which the salaries of unmarried women maintain the home for the mother, make possible the college education of younger brothers or sisters, or provide in some other way for the members of the family. If such instances are at all numerous, and especially in view of the fact that lower salaries are very generally paid to women who, in the colleges, very largely make up the group of unmarried teachers, the new plan is clearly based on assumptions which the facts do not bear out.

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* Prepared for the Mount Holyoke College Committee on Pensions and Insurance.

The present inquiry is an attempt to throw light on this situation. It was made possible by the coöperation of four of the larger colleges for women, Smith, Vassar, Wellesley, and Mount Holyoke. The replies upon which this report is based were received in the spring of 1919 from members of the faculty and staff of the rank of instructor and above, excluding executives not ranked with the faculty on the college lists. A marked degree of interest and care in filling out the records appears to have been taken, and only in a small number of instances was it necessary to throw out schedules because of ambiguity or the omission of the most significant information. Only a few of the college teachers showed reluctance to give material on account of the personal nature of the information.

The teachers who reported are distributed as follows among the four colleges:

Mount Holyoke	77
Smith	73
Vassar	61
Wellesley	72
Total	283

Forty-four were men, 38 of whom were married, and 239 were women, 7 of whom were married. According to rank the distribution is as follows:

Professors	80
Associate Professors	64
Assistant Professors	47
Instructors	92

The material has been summarized in such form as to answer as pointedly as possible the questions which have been asked most frequently concerning the dependents of college teachers.

How many of the whole group of teachers are contributing to the support of others?

The following table shows that nearly one-half (48.4 per cent.) of the whole group of college teachers were contributing to the support of other persons. Although the proportion of teachers who were making such contributions varies somewhat among the colleges, it is a substantial one in every case.

TABLE I.

NUMBER AND PER CENT. OF COLLEGE TEACHERS WITH AND WITHOUT DEPENDENTS.

College	Total number of teachers reporting	Teachers with dependents		Teachers without dependents	
		Number	Per cent.	Number	Per cent.
All Colleges	283	137	48.4	146	51.6
Mt. Holyoke	77	36	46.8	41	53.2
Smith	73	43	58.9	30	41.1
Vassar	61	30	49.2	31	50.8
Wellesley	72	28	38.9	44	61.1

What proportion of the unmarried teachers have persons dependent upon them?

Two-fifths (41.2 per cent.) of the unmarried teachers—and it is to be borne in mind that this group is composed almost entirely of women—were contributing to the support of other persons. This dependency was in some cases only partial, but, on the other hand, it frequently included two or more persons, and had often been maintained over a term of years.

These unmarried teachers, constituting the main part of the faculty in each of the four colleges included in this study, make up the group which is to have one-third of the retiring allowance deducted, according to the new plan of the Carnegie Foundation.

TABLE II.

COMPARISON OF MARRIED AND UNMARRIED TEACHERS, SHOWING THE NUMBER AND PER CENT. CONTRIBUTING TO THE SUPPORT OF OTHERS.

College	Total number of teachers reporting	Married teachers		Unmarried teachers	
		With dependents	Without dependents	With dependents	Without dependents
All Colleges	283	39 86.7 per cent.	6 13.3 per cent.	98 41.2 per cent.	140 58.8 per cent.
Mt. Holyoke	77	5	..	31	41
Smith	73	16	4	27	26
Vassar	61	12	1	18	30
Wellesley	72	6	1	22	43

Is the person who contributes to the support of others handicapped in making provision for his own old age?

It is significant that relatively fewer of the teachers who had dependents had made provision for their own old age, in the form of accumulated savings, investments, annuities, endowment policies, or otherwise. The care of others obviously makes it difficult to lay aside funds for the rainy day. More than one-fourth (26.3 per cent.) of the teachers who were contributing to the support of others had made no provision of any kind for the future. On the other hand, all but 19.4 per cent. of the teachers who had no responsibilities of this nature had provided in some way for old age.

TABLE III.

COMPARISON OF TEACHERS WITH DEPENDENTS AND TEACHERS WITHOUT DEPENDENTS, SHOWING THE PROVISION MADE FOR OLD AGE.*

College	Number reporting as to provision for old age	Teachers with dependents		Teachers without dependents	
		With provision for old age	*Without* provision for old age	With provision for old age	*Without* provision for old age
All Colleges ...	281	101 73.7 per cent.	36 26.3 per cent.	116 80.6 per cent.	28 19.4 per cent.
Mt. Holyoke ..	76	27	9	34	6
Smith	73	26	17	23	7
Vassar........	61	24	6	22	9
Wellesley	71	24	4	37	6

* Savings or investments the principal of which amounted to less than $500 are not included in this table.

Is the teacher who has persons dependent upon him nearer to old age than the teacher without dependents?

The preceding table, showing the handicap of the teacher with dependents in making financial provision for old age, is even more significant when considered in connection with the comparison of the ages of teachers with and without dependents. Obviously the older teachers, whose salaries have presumably increased with advancing years, are the ones who would most frequently be able to contribute to the support of others. Thus the group *with* dependents shows a higher average age (43.5 years) than the independent group (40.0 years). This means, however, that the people who are, on the average, three and one-half years nearer to retirement and the necessity of some financial support when earnings cease, are precisely the people who, on account of their present duties, are less often able to save.

TABLE IV.

COMPARATIVE AGES OF TEACHERS WITH DEPENDENTS AND TEACHERS WITHOUT DEPENDENTS.

College	Average age		
	All teachers	Teachers with dependents	Teachers without dependents
All Colleges	41.7	43.5	40.0
Mt. Holyoke	42.4	45.4	39.7
Smith	42.2	43.0	40.9
Vassar	39.6	42.0	37.4
Wellesley	42.3	43.5	41.6

To what extent are college salaries supplemented from outside sources?

A further handicap of the teachers who are supporting others is indicated by an analysis of the extent to which the two groups, those with and without dependents, are able to supplement the college salary. Less than one-half (45.5 per cent.)

TABLE V.

COMPARISON OF TEACHERS WITH DEPENDENTS AND TEACHERS WITHOUT DEPENDENTS, SHOWING EXTENT TO WHICH THE COLLEGE SALARIES ARE SUPPLEMENTED FROM OUTSIDE SOURCES.*

College	With dependents			Without dependents		
	Number of teachers reporting	Teachers whose salaries are supplemented		Number of teachers reporting	Teachers whose salaries are supplemented	
		Number	Per cent.		Number	Per cent.
All Colleges	132	60	45.5	136	74	54.4
Mt. Holyoke	36	15	41.7	37	20	54.1
Smith	41	16	39.0	30	19	63.3
Vassar	29	12	41.4	28	13	46.4
Wellesley	26	17	65.4	41	22	53.7

* Unless the outside income amounted to more than 5 per cent. of the whole income, the college salary is classified as unsupplemented. Several persons noted that the income from other sources appeared as an appreciable percentage only because the college salary was so small.

of the teachers with dependents have a source of outside income, while more than one-half (54.4 per cent.) of those who have no dependents have other incomes. The relation between the two groups holds good in each of the colleges except Wellesley. It is probably an indication that the care of dependents, as far as the present is concerned, makes demands upon time and energy which would otherwise be spent in outside work, resulting in additional income; and, in the past, has meant the inability to save or invest to an extent which yields any considerable income at the present time. In so far as this is the case, the money contribution is by no means a complete measure of the contribution to dependents; for the earning capacity of the contributor is also mortgaged.

What proportion of the dependents of married teachers will presumably contribute later, in return, to the support of the teachers, as compared with the proportion for the dependents of unmarried teachers?

Turning from a comparison of the economic positions of the group *with* dependents and the group *without* dependents to a comparison of *married and unmarried* persons, it becomes clear, again, that the assumptions upon which the new Carnegie plan apparently rests are not wholly valid. It is assumed, for example, that the needs of the unmarried person, as represented in the allowance after retirement, are two-thirds of those of the married person. In order to ascertain as definitely as possible the relative positions of the two groups at retiring age, when the children—the principal dependents of the married persons—will as a rule be over 21, a comparison is made of the proportions of married and unmarried teachers with dependents who are at present contributing to the support of children under 21. These children in either case, although less probably in the case of the unmarried, may be expected to contribute to the support of those persons who formerly supported them, if old age makes it necessary. The figures prove to be strikingly different for the two groups: more than three-fifths (61.5 per cent.) of the married teachers had dependents under 21, while less than one-fifth (19.4 per cent.) of the unmarried teachers were contributing to the support of children under 21.

The reverse view of the situation is this: the unmarried teachers are contributing to the support of older people, in many cases parents, who will certainly never be able to make financial returns for the support.

Throughout the comparison of the two groups (married and unmarried persons) it should be kept in mind that the number of married teachers with dependents included in this study (39) is so small that it may be a precarious basis for generalizations. On the other hand, in most respects the groups in the four colleges show similar tendencies, showing that to some extent the material reflects the main trends of the groups.

TABLE VI.

COMPARISON OF MARRIED AND UNMARRIED TEACHERS WHO HAVE DEPENDENTS, SHOWING THE PROPORTION WHO HAVE DEPENDENTS UNDER 21 YEARS OF AGE.

College	Married teachers		Unmarried teachers	
	With dependents under 21	Without dependents under 21	With dependents under 21	Without dependents under 21
All Colleges..	24 61.5 per cent.	15 38.5 per cent.	19 19.4 per cent.	79 80.6 per cent.
Mt. Holyoke.	3	2	5	26
Smith.......	11	5	6	21
Vassar......	6	6	4	14
Wellesley....	4	2	4	18

To what extent do unmarried teachers bear the support of their families?

There is little room for doubt that to a marked extent the larger share of the responsibility for the care of fathers, mothers, brothers, and sisters falls on the unmarried son or daughter. In the case of a married person, the care of his own home often seems the most pressing need, and it is a natural, although possibly not always a justifiable procedure, to leave the care of parents and handicapped brothers and sisters to the unmarried woman in the family, whose salary is, nevertheless, ordinarily considerably smaller. The following table shows that less than one-fourth (23.1 per cent.) of the married persons with dependents among the college teachers contribute even to the partial support of parents or brothers or sisters, while more than four-fifths (80.6 per cent.) of the unmarried teachers with dependents contribute to the maintenance of this group of relatives.

TABLE VII.

COMPARISON OF MARRIED AND UNMARRIED TEACHERS WITH DEPENDENTS, SHOWING THE NUMBER AND PER CENT. OF EACH GROUP WHO ARE SUPPORTING PARENTS, BROTHERS, OR SISTERS.

College	Married teachers		Unmarried teachers	
	Supporting fathers, mothers, brothers, or sisters.	NOT supporting fathers, mothers, brothers, or sisters.	Supporting fathers, mothers, brothers, or sisters.	NOT supporting fathers, mothers, brothers, or sisters.
All Colleges	9 23.1 per cent.	30 76.9 per cent.	79 80.6 per cent.	19 19.4 per cent.
Mt. Holyoke	..	5	23	8
Smith	3	13	25	8
Vassar	4	8	12	6
Wellesley	2	4	19	3

How do married and unmarried persons compare with respect to the amount of help which they give to their dependents?

The ways of estimating the weight of the burden which is borne by persons who have others dependent upon them, include the determination of the number of *total* dependents, that is, the number of persons who have no other means of support than the contributions received from the group under consideration; and, also, the determination of the drain upon the supporting person as indicated by the part of his income which he gives up. For such a study as the present, in which the dependents range from infants to very old people, the former is a less useful index, since the actual amounts necessary for the full support of persons of different ages vary so greatly; the latter, which is based upon a consideration of the part of the salary devoted to the care of the dependents, has accordingly been used as a significant index of the money sacrifice which the teacher makes.

The following table shows that the burden borne by the married teacher is markedly greater; more than four-fifths (82.4 per cent.) of the married teachers devote more than one-third* of their college salaries to the maintenance of dependents, while the majority of the unmarried teachers spend only one-third, or less, for the support of others. While this shows the relatively greater drain in the case of the married people, it should be taken into account that the salaries of the unmarried teachers, almost all of whom are women, are lower, and that the fraction of the salary remaining for their own use represents a smaller sum in terms of dollars. Moreover, the sacrifice of the married teachers, although greater, is a sacrifice for the present only, and will in many cases be repaid in kind; while the unmarried persons bear the support of their parents and brothers and sisters, who will almost never take their turn at support.

TABLE VIII.

COMPARISON OF MARRIED AND UNMARRIED TEACHERS WITH DEPENDENTS, SHOWING THE PROPORTION OF THE SALARY SPENT ON THE MAINTENANCE OF DEPENDENTS.

College	Number reporting per cent. spent for dependents	Married teachers		Unmarried teachers	
		Spending one-third of salary, or less, for dependents	Spending more than one-third of salary for dependents	Spending one-third of salary, or less, for dependents	Spending more than one-third of salary for dependents
All Colleges ...	132	6 17.6 per cent.	28 82.4 per cent.	66 67.3 per cent.	32 32.7 per cent.
Mt. Holyoke ..	36	1	4	22	9
Smith	40	1	12	17	10
Vassar........	28	3	7	11	7
Wellesley	28	1	5	16	6

SUMMARY AND CONCLUSIONS.

It has been shown that a substantial number (two-fifths) of the unmarried teachers in the four large women's colleges included in this study contribute to the support of others, to an extent which sometimes prohibits providing for their own old age. The part of their incomes which they contribute to the support of their dependents is not so large, in most cases, as the part contributed by the married teachers; but it is largely devoted to the support of older people, who will probably continue to be dependent as long as they live, while the majority of the married people have children who will later be responsible for the maintenance of themselves and their parents. Moreover, the unmarried have a larger financial burden—relatively to the married—than is commonly recognized. It is commonly assumed that when a man "supports his wife" she makes no return to him. On the contrary, in the case of people in moderate circumstances the wife often does many things for the husband which save expense to him. The unmarried woman must either do these things for herself, thus taking time which might be used in supplementing her income, or she must pay a good price for having them done. It is true that sometimes the unmarried woman *with dependents* has these things done for her, but often the conditions of the dependency are such that she does not.

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* One-third corresponds to the rate at which it is proposed to reduce the allowances of unmarried teachers.

A further consideration is this: the married man with dependents almost invariably lives with these dependents. The unmarried college teacher, with dependents, frequently does not live with them. The cost for board and lodging for a person living alone is relatively greater than for the same person living as member of a family.

The aim of the retiring allowance system is to provide for a dignified and comfortable old age for persons whose best years have been given to the cause of education in the colleges. Since it is not contended that the service of a college teacher is inferior because he is unmarried, and since he, as well as the married teacher, has in many cases undertaken a considerable financial burden during his teaching years, the discrimination made by subtracting one-third of his retiring allowance should be lessened, and possibly eliminated altogether.

AUTOMOBILE, MOTOR-TRUCK AND MOTOR-CYCLE STREET ACCIDENTS IN CHICAGO.

By Horace Secrist, *Northwestern University.*

In this study of automobile, motor-truck and motor-cycle street accidents in Chicago for the four months, April, July and November, 1918, and January, 1919, data copied from the police records have been employed.*

The facts used in this study were transcribed directly from these reports on to cards. It was necessary to scrutinize the entire record for each month, inasmuch as the reports are filed alphabetically after having been used in the listing process adopted by the police office. How many accidents of the type under consideration were omitted, because of the peculiar way in which the reports are filed, it is impossible to say, but undoubtedly the number would not be more than 1 per cent. There is some occasion also for error in the transcription process, but this is not large. Moreover, these data include only the reports sent in by the Police Department of the city of Chicago, and do not include those accidents occuring in the South Park, West Park and Lincoln Park areas.

No attempt was made to compare the classification as to the cause of the accident, report by report, with that used by the police. However, the blanks reporting accidents resulting in fatalities were specially marked, and for this group the identity of the classification is complete.

The virtue of the data, however, does not primarily consist in their inclusiveness, but rather in their comparative aspects. It is this side of the problem which is given primary stress in the following analysis.

Figures furnished the writer by the Police Department for 1918 show a total of 5,168 automobile, motor-truck and motor-cycle accidents, 302 of which were fatal, and 4,866, non-fatal. Relatively, the relationship between the fatal and the non-fatal accidents for the entire year as thus reported stands as 5.8 to 94.2. For the three months of 1918—April, July and November—considered in this study, the relationship stands as 5.9 to 94.1. The three months' record, for both the fatal and the non-fatal accidents, bears the following relationship to the total for the year: fatal, 19.2* per cent.; non-fatal, 19.1* per cent.

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* The original data were secured and the preliminary analysis made by Miss Evelyn Meyer, one of the author's students at Northwestern University. The writer is under obligation to Miss Meyer for her careful and painstaking work in handling the details.

I. FATAL AND NON-FATAL ACCIDENTS.

For the period covered in this study eleven hundred and ninety-six automobile, motor-truck and motor-cycle accidents occurred. Of these, sixty-eight were fatal,† and eleven hundred and twenty-eight non-fatal. The number and per cent. distributions by months are given in the following table:

TABLE I.

TABLE SHOWING THE NUMBER AND PER CENT. DISTRIBUTION OF FATAL AND NON-FATAL ACCIDENTS BY MONTHS.

Months	Total			Fatal			Non-fatal		
	Number	Per cent.		Number	Per cent.		Number	Per cent.	
Total.......	1196	100.0	*100.0*	68	100.0	*5.7*	1128	100.0	*94.3*
April, 1918....	277	23.2		16	23.5		261	23.1	
Per cent.......			*100.0*			*5.8*			*94.2*
July, 1918....	308	25.8		13	19.1		295	26.2	
Per cent.......			*100.0*			*4.2*			*95.8*
November 1918	401	33.5		29	42.6		372	33.0	
Per cent.......			*100.0*			*7.2*			*92.8*
January, 1919 .	210	17.5		10	14.8		200	17.7	
Per cent.......			*100.0*			*4.8*			*95.2*

For the four months as a total, one accident in seventeen was fatal; for April, one in sixteen; July, one in twenty-three; November, one in thirteen; January, one in twenty. If the number of fatal accidents in April, 1918, be taken as one hundred, the months of July, November, 1918, and January, 1919, are respectively 81.2, 181.2, 62.5. Relatively, month by month, the number of fatal accidents differs considerably,

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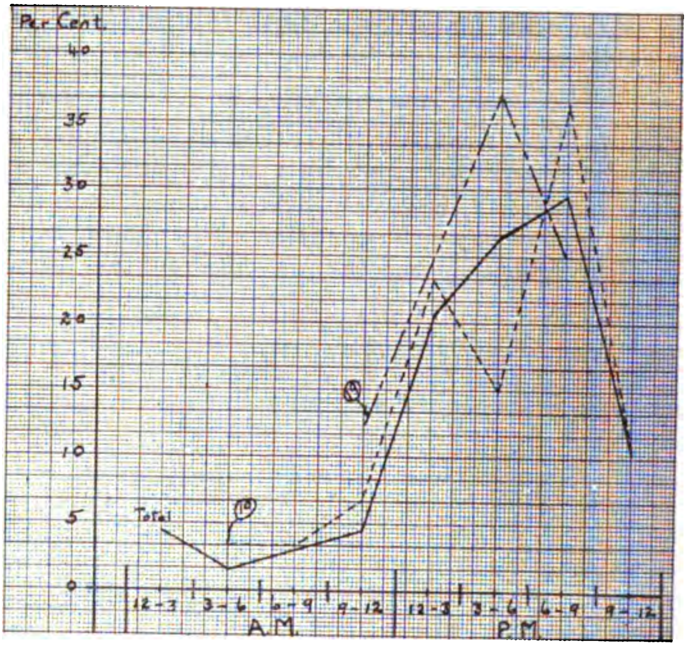
[*] This per cent. is distinctly too low, as the proportion attributable to a three months' period—if the figures furnished by the Police Department for 1918 are accepted as correct, and if the assumption is made that these months are quantitatively representative.

[†] By a fatal accident, according to the interpretation put upon the reports by the Police Department, is meant any accident resulting immediately in death, or which is later reported as fatal at the time of the coroner's inquest.

but as a proportion of all accidents it constitutes a stable factor.

GRAPH 1.

GRAPH SHOWING THE PER CENT. DISTRIBUTION OF FATAL ACCIDENTS BY MAJOR CAUSES* AND BY TIME OF THE DAY.



II. FATAL ACCIDENTS.†

During the four months under consideration, sixty-eight fatal accidents occurred. Thirty, or 44.1 per cent., were due to cause ten—"struck by automobile"; thirteen, or 19.1 per cent. to causes nineteen and twenty—"struck or run over by auto-truck"; and the balance, twenty-five, or 36.8 per cent. to other causes.‡ Of the sixty-eight, fifty-nine, or 86.8 per cent.

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[*] See note to Table 5.

[†] For meaning, see note †, page 513.

[‡] Seven accidents from automobile struck by street car; 2 accidents from collisions of automobiles; 1 accident from motor-cycle struck by automobile; 6 accidents—run over by automobile; 1 accident—struck by motor-cycle; 1 accident—falling or thrown from automobile; 1 accident—hitching on automobile; 1 accident—auto-truck and automobile; 1 accident—auto-truck and motor-cycle; 1 accident—auto-truck and street car; 1 accident from skidding; 2 accidents—automobile running into structure.

occurred in the p. m., hours 12 to 12, and nine, or 13.2 per cent. occurred in the a. m., hours 12 to 12. Of the fifty-nine occurring in the p. m. hours, fourteen, or 23.7 per cent., happened between 12 and 3 p. m.; eighteen, or 30.5 per cent., between 3 and 6 p. m.; twenty, or 33.9 per cent., between 6 and 9 p. m. Of the nine occurring in the a. m. hours, three, or 33.3 per cent., happened between 12 midnight and 3 a. m. The above and other relations are set out in Tables II and III and in Graphs 1 and 2.

TABLE II.

TABLE SHOWING FATAL ACCIDENTS CLASSIFIED BY CAUSE AND HOUR OF THE DAY.

Hourly Groups	Fatal Accidents									
	Total		Cause 10*		Cause 19*		Cause 20†		Other	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total......	68	100.0	30	100.0	8	100.0	5	100.0	25	100.0
A. M.										
12 to 3.....	3	4.4	..	....	..	....	..	....	3	12.0
3 to 6.....	1	1.5	1	3.3	..	....	..	....	..	....
6 to 9.....	2	2.9	1	3.3	..	....	..	....	1	4.0
9 to 12....	3	4.4	2	6.7	1	12.5	..	....	..	....
P. M.										
12 to 3.....	14	20.6	7	23.3	2	25.0	..	....	5	20.0
3 to 6.....	18	26.5	5	16.7	3	37.5	2	40.0	8	32.0
6 to 9.....	20	29.4	11	36.7	2	25.0	3	60.0	4	16.0
9 to 12....	7	10.3	3	10.0	..	....	..	....	4	16.0

* See note to Table V.
† Run over by auto-truck.

TABLE III.

TABLE SHOWING RELATIONSHIP OF FATAL ACCIDENTS OCCURRING IN THE A. M. HOURS TO THOSE OCCURRING IN THE P. M. HOURS.

Hourly Groups	Fatal Accidents			
	Number		Per cent.	
Total......................		68		100.0
A. M.		9	100.0	13.2
12 to 3.....................	3		33.3	
3 to 6.....................	1		11.1	
6 to 9.....................	2		22.3	
9 to 12.....................	3		33.3	
P. M.		59	100.0	86.8
12 to 3.....................	14		23.7	
3 to 6.....................	18		30.5	
6 to 9.....................	20		33.9	
9 to 12.....................	7		11.9	

GRAPH 2.

GRAPH SHOWING THE PER CENT. DISTRIBUTION CUMULATIVELY OF BOTH FATAL AND NON-FATAL ACCIDENTS BY TIME OF THE DAY.

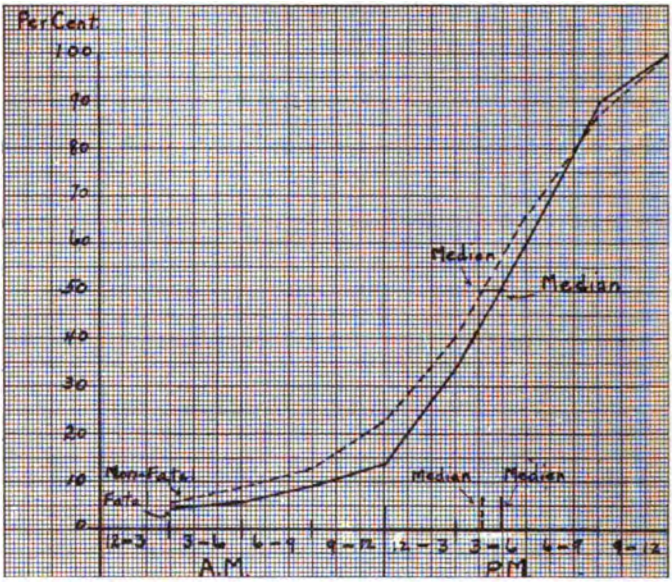


TABLE IV.

TABLE SHOWING FATAL ACCIDENTS BY DAYS AND BY THE A. M. AND P. M. HOURS.

Days	Total			A. M.			P. M.		
	Number	Per cent.		Number	Per cent.		Number	Per cent.	
Total.......	68	100.0	*100.0*	9	100.0	*13.2*	59	100.0	*86.8*
Sunday	4	5.9		1	11.1		3	5.1	
Per cent....			*100.0*			*25.0*			*75.0*
Monday......	18	26.5		..	....		18	30.5	
Per cent....			*100.0*			....			*100.0*
Tuesday......	9	13.2		3	33.3		6	10.2	
Per cent....			*100.0*			*33.3*			*66.7*
Wednesday ...	11	16.2		1	11.1		10	16.9	
Per cent....			*100.0*			*9.9*			*90.1*
Thursday.....	12	17.6		2	22.3		10	16.9	
Per cent....			*100.0*			*16.6*			*83.4*
Friday.......	3	4.4		..	....		3	5.1	
Per cent....			*100.0*			....			*100.0*
Saturday.....	11	16.2		2	22.2		9	15.3	
Per cent....			*100.0*			*18.2*			*81.8*

In Table IV the fatal accidents are distributed by the a. m. and p. m. hours, for the days of the week for the four-month period. The per cent. distribution by hours and by days is also included.

III. NON-FATAL ACCIDENTS.

During the four months under consideration, one thousand one hundred and twenty-eight non-fatal automobile, motor-truck, and motor-cycle accidents occurred. These were distributed as a total by months as shown in Table I. By major causes the distribution is shown in Table V.

TABLE V.

TABLE SHOWING DISTRIBUTION OF NON-FATAL ACCIDENTS BY PRINCIPAL CAUSES.

Causes*	Non-fatal Accidents			
	Number		Per cent.	
Total		1128		100.0
10	595	855	52.7	75.8
5	101		9.0	
9	88		7.8	
1	71		6.3	
others	273	273	24.2	24.2

* Cause 10—Struck by automobiles.
Cause 5—Collision of automobiles.
Cause 9—Run over by automobiles.
Cause 1—Automobiles struck by cars.

A single cause, number 10—struck by automobile—is responsible for 52.7 per cent. of the non-fatal accidents; while four causes, numbers 10, 5, 9, and 1, covers 75.8 per cent. of all the instances. The "other" causes, responsible for 24.2 per cent. of the accidents are distributed over twenty-nine captions.

The accidents by main causes are distributed by months in Table VI.

TABLE VI.

TABLE SHOWING NON-FATAL ACCIDENTS DISTRIBUTED BY MONTHS AND BY CAUSES.

Months	Causes*											
	Total		10		5		19		1		Other	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	1128	100.0	595	100.0	101	100.0	88	100.0	71	100.0	273	100.0
April, '18	261	23.1	134	22.5	19	18.8	18	20.5	13	18.3	77	28.2
July, '18	295	26.2	139	23.4	32	31.7	26	29.5	10	14.1	88	32.2
November, '18	372	33.0	209	35.1	33	32.7	19	21.6	29	40.8	82	30.1
January, '19	200	17.7	113	19.0	17	16.8	25	28.4	19	26.8	26	9.5

* See note to Table V.

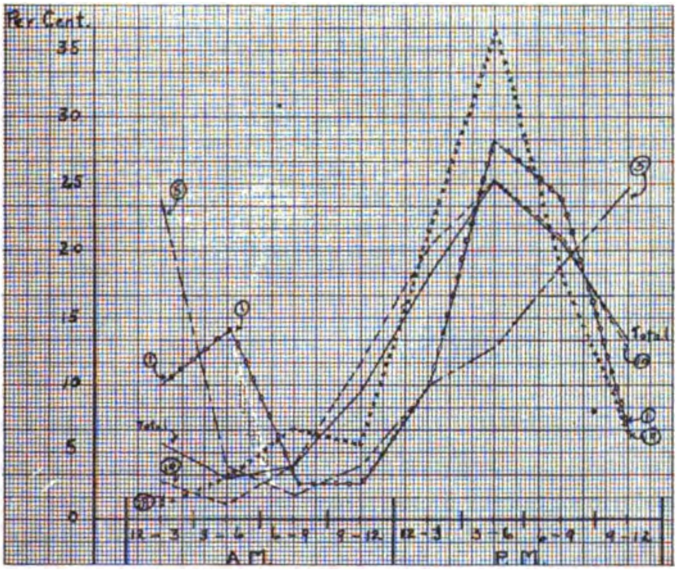
TABLE VII.

TABLE SHOWING NON-FATAL ACCIDENTS CLASSIFIED BY PRINCIPAL CAUSES AND HOURLY GROUPS.

Hourly groups	Specific Causes*									
	Total		10		5		19		1	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total......	855	100.0	595	100.0	101	100.0	88	100.0	71	100.0
A. M.										
12–3.......	49	5.7	17	2.9	24	23.8	1	1.1	7	9.9
3–6.......	27	3.2	10	1.7	4	4.0	3	3.4	10	14.1
6–9.......	34	4.0	24	4.0	2	2.0	6	6.8	2	2.8
9–12......	82	9.6	71	11.9	4	4.0	5	5.7	2	2.8
P. M.										
12–3.......	157	18.4	121	20.3	10	9.9	19	21.6	7	9.9
3–6.......	215	25.1	150	25.2	13	12.9	32	36.4	20	28.2
6–9.......	178	20.8	126	21.2	19	18.8	16	18.2	17	23.9
9–12......	113	13.2	76	12.8	25	24.6	6	6.8	6	8.3
Number P.M.	663		473		67		73		50	
Per Cent. P.M.		77.5		79.5		66.3		83.0		70.4

GRAPH 3.

GRAPH SHOWING THE PER CENT. DISTRIBUTION OF NON-FATAL ACCIDENTS BY TIME OF THE DAY BY MAJOR CAUSES.†



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* See note to Table V.

† See note to Table 5.

By distributing by hours of the day and by major causes the non-fatal accidents occurring during the four-month period, some interesting comparisons follow:

Collision of automobiles are responsible for one hundred and one accidents within the four-month period. Of these, twenty-five, or 24.7 per cent., occur between the hours 9 to 12 p. m., and twenty-four, or 23.8 per cent., between 12 midnight and 3 a. m. Together this six-hour period—one quarter of the day—represents forty-nine instances, or 48.5 per cent. of all the accidents from this cause. Relatively, the period 12 midnight to 3 a. m., for collisions, is as important as the periods 3 to 6, or 6 to 9 p. m. for cause 10—struck by automobile—or 12 to 3 p. m. for cause 19—struck by motortruck. The number and per cent. distribution of non-fatal accidents for specific causes during the four-month period is set out in Table VII and Graph 3.

TABLE VIII.

TABLE SHOWING NON-FATAL ACCIDENTS FROM SPECIFIC CAUSES DISTRIBUTED BY MONTHS AND BY HOURLY GROUPS.

Hourly groups	Months									
	Total		April, 1918		July, 1918		November, 1918		January, 1919	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	855	100.0	184	100.0	207	100.0	290	100.0	174	100.0
A.M.										
12–3	49	5.7	8	4.3	13	6.3	16	5.5	12	6.9
3–6	27	3.2	2	1.1	4	1.9	16	5.5	5	2.9
6–9	34	4.0	10	5.4	7	3.4	10	3.5	7	4.0
9–12	82	9.6	16	8.7	23	11.1	33	11.4	10	5.8
P.M.										
12–3	157	18.4	38	20.7	49	23.7	33	11.4	37	21.2
3–6	215	25.1	46	25.0	51	24.6	77	26.5	41	23.6
6–9	178	20.8	35	19.0	30	14.5	69	23.8	44	25.3
9–12	113	13.2	29	15.8	30	14.5	36	12.4	18	10.3
Number P.M.	663		148		160		215		140	
Per cent. P.M.		77.5		80.4		77.3		74.1		80.5

The eight hundred and fifty-five non-fatal accidents occurring during the four months, due to the specific causes 10, 5, 19, and 1, are distributed by months and by hourly groups in Table VIII.

Cause 10—struck by automobiles—contributed five hundred and ninety-five, or 52.7 per cent. of the non-fatal accidents from specific causes. These were distributed among the months, April, July, and November, 1918 and January, 1919, respectively, as follows: 22.5 per cent.; 23.4 per cent.; 35.1 per cent. and 19.0 per cent.

By days of the week during the four-month period, the non-fatal accidents from specific causes are set out below.

TABLE IX.

TABLE SHOWING NON-FATAL ACCIDENTS DUE TO SPECIFIC CAUSES DISTRIBUTED BY MONTHS AND DAYS OF THE WEEK.

Days	Months									
	Total		April, 1918		July, 1918		November, 1918		January, 1919	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	855	100.0	184	100.0	207	100.0	290	100.0	174	100.0
Sunday	94	11.0	24	13.0	24	11.6	30	10.3	16	9.2
Monday	143	16.7	33	17.9	27	13.0	67	23.1	16	9.2
Tuesday	96	11.2	20	10.9	24	11.6	33	11.4	19	10.9
Wednesday	114	13.3	17	9.2	41	19.8	31	10.7	25	14.4
Thursday	116	13.6	29	15.8	22	10.6	41	14.1	24	13.8
Friday	130	15.2	22	12.0	33	16.0	39	13.5	36	20.7
Saturday	162	19.0	39	21.2	36	17.4	49	16.9	38	21.8

The distribution by specific causes for the several days of the week is shown below.

TABLE X.

TABLE SHOWING NON-FATAL ACCIDENTS BY SPECIFIC CAUSES BY DAYS OF THE WEEK.

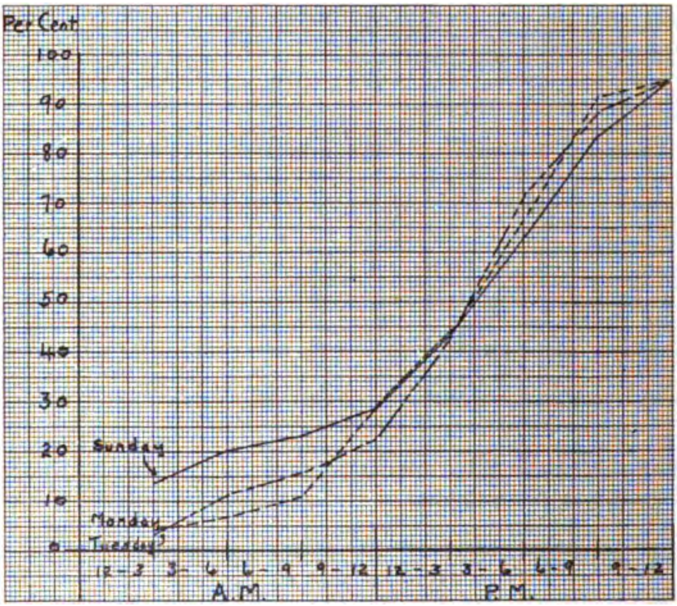
Days	Specific Causes*									
	Total		10		5		19		1	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	855	100.0	595	100.0	101	100.0	88	100.0	71	100.0
Sunday	94	11.0	54	9.1	25	24.8	1	1.1	14	19.7
Monday	143	16.7	113	19.0	11	10.9	12	13.6	7	9.9
Tuesday	96	11.2	66	11.0	11	10.9	10	11.4	9	12.7
Wednesday	114	13.3	86	14.5	9	8.9	11	12.5	8	11.3
Thursday	116	13.6	79	13.3	12	11.9	11	12.5	14	19.7
Friday	130	15.2	88	14.8	17	16.8	22	25.0	3	4.2
Saturday	162	19.0	109	18.3	16	15.8	21	23.9	16	22.5

* See note to Table V.

The hourly distribution of the non-fatal accidents from specific causes, as a total for the days of the week during the four-month period under consideration, reveals some interesting comparison. The absolute and comparative data are given in Table XI and in Graphs 4 and 5.

GRAPH 4.

GRAPH SHOWING THE PER CENT. DISTRIBUTION CUMULATIVELY OF NON-FATAL ACCIDENTS BY DAYS AND TIME OF THE DAY.



Approaching the non-fatal accidents from another angle, that is, from the point of view of the distribution by hourly groups during successive days for the four-month period, the following details are interesting: Of the forty-nine accidents occuring between midnight and 3 a. m., thirteen, or 26.6 per cent., happened on Sundays, and eleven, or 22.5 per cent. on Fridays. For the period 3 to 6 a. m., six or 22.3 per cent., occurred on Sundays, and eight, or 29.6 per cent., on Tuesdays. The period, 9 to 12 p. m., is responsible for one hundred and thirteen accidents. Of these fifteen, or 13.3 per cent., occurred Sunday, and thirty-seven, or 32.7 per cent., on Saturday evenings.

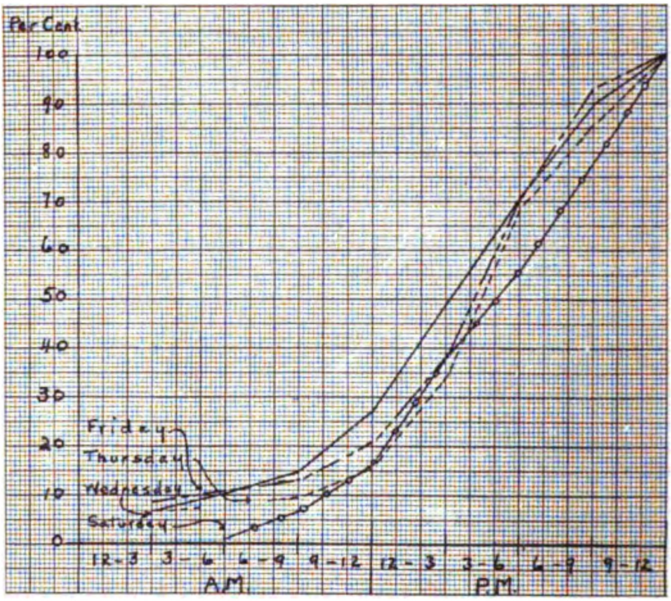
TABLE XI.

TABLE SHOWING NON-FATAL ACCIDENTS FROM SPECIFIC CAUSES CLASSIFIED BY DAYS AND BY HOURLY GROUPS.

Hourly groups	Days of the Week															
	Total		Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	855	100.0	94	100.0	143	100.0	96	100.0	114	100.0	116	100.0	130	100.0	162	100.0
A.M.																
12 to 3	49	5.7	13	13.8	6	4.1	3	3.1	8	7.0	8	6.9	11	8.5	...	....
3 to 6	27	3.2	6	6.4	4	2.8	8	8.3	4	3.5	...	....	3	2.3	2	1.2
6 to 9	34	4.0	3	3.2	6	4.2	4	4.2	5	4.4	3	2.6	4	3.1	9	5.6
9 to 12	82	9.6	5	5.3	25	17.5	7	7.3	14	12.3	7	6.0	9	6.9	15	9.3
P.M.																
12 to 3	157	18.4	14	14.9	23	16.1	19	19.8	24	21.1	21	18.1	22	16.9	34	21.0
3 to 6	215	25.1	19	20.2	31	21.7	28	29.2	25	21.9	40	34.5	42	32.3	30	18.5
6 to 9	178	20.8	19	20.2	36	25.2	16	16.7	22	19.3	20	17.3	30	23.1	35	21.6
9 to 12	113	13.2	15	16.0	12	8.4	11	11.4	12	10.5	17	14.6	9	6.9	37	22.8
Number P.M.	663		67		102		74		83		98		103		136	
Per cent P.M.		77.5		71.3		71.3		77.1		72.8		84.5		79.2		83.9

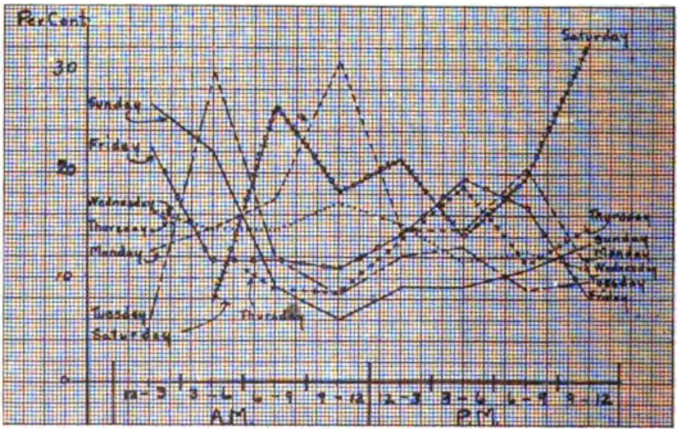
GRAPH 5.

GRAPH SHOWING THE PER CENT. DISTRIBUTION CUMULATIVELY OF NON-FATAL ACCIDENTS BY DAYS AND TIME OF THE DAY.



GRAPH 6.

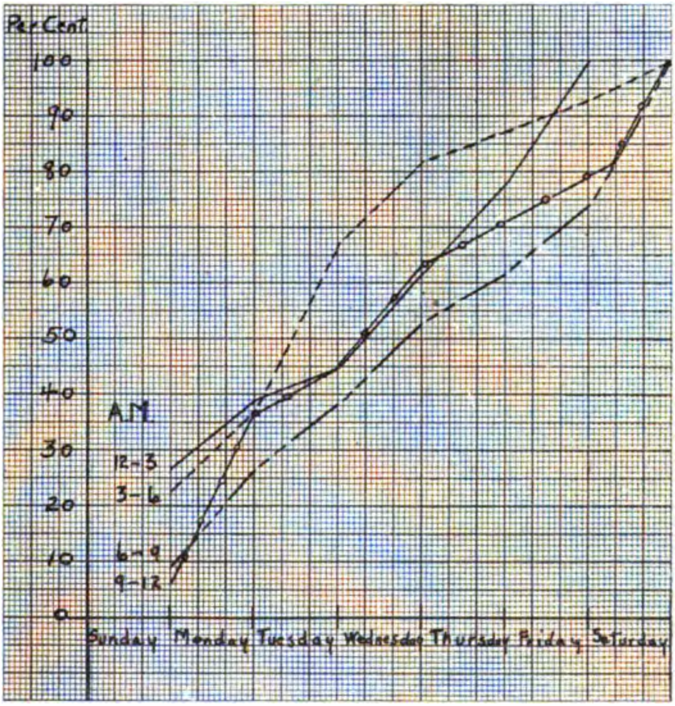
GRAPH SHOWING THE PER CENT. DISTRIBUTION OF NON-FATAL ACCIDENTS THROUGHOUT EACH DAY OF THE WEEK BY TIME OF THE DAY.



The above relations for the 9 to 12 p. m. period, as well as for the others during the twenty-four hours, are specifically set out both absolutely and relatively in Table XII and in Graphs 6, and 7 and 8. On Graph 6 the accidents for the several days are distributed by hourly groups, and in Graphs 7 and 8, the accidents by hourly groups are distributed cumulatively throughout the week.

GRAPH 7.

GRAPH SHOWING THE PER CENT. DISTRIBUTION OF NON-FATAL ACCIDENTS BY A. M. HOURLY GROUPS THROUGHOUT EACH DAY OF THE WEEK.



Similarly, Table XIII shows the distribution of the five hundred and ninety-five non-fatal accidents resulting from cause 10—being struck by automobiles.

TABLE XII.

TABLE SHOWING NON-FATAL ACCIDENTS DUE TO SPECIFIC CAUSES CLASSIFIED BY HOURLY GROUPS AND DISTRIBUTED BY DAYS OF THE WEEK.

Hourly groups	Days															
	Total		Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	855	100.0	94	11.0	143	16.7	96	11.2	114	13.3	116	13.6	130	15.2	162	19.0
A.M.																
12 to 3	49	100.0	13	26.6	6	12.2	3	6.1	8	16.3	8	16.3	11	22.5	..	....
3 to 6	27	100.0	6	22.3	4	14.8	8	29.6	4	14.8	..	....	3	11.1	2	7.4
6 to 9	34	100.0	3	8.8	6	17.6	4	11.8	5	14.7	3	8.8	4	11.8	9	26.5
9 to 12	82	100.0	5	6.1	25	30.5	7	8.5	14	17.1	7	8.5	9	11.0	15	18.3
P.M.																
12 to 3	157	100.0	14	8.9	23	14.6	19	12.1	24	15.3	21	13.4	22	14.0	34	21.7
3 to 6	215	100.0	19	8.8	31	14.4	28	13.0	25	11.6	40	18.6	42	19.5	30	14.1
6 to 9	178	100.0	19	10.7	36	20.2	16	9.0	22	12.4	20	11.2	30	16.8	35	19.7
9 to 12	113	100.0	15	13.3	12	10.6	11	9.7	12	10.6	17	15.0	9	8.0	37	32.7
Number P.M.	663		67		102		74		83		98		103		136	
Per cent P.M.		100.0		10.1		15.4		11.2		12.5		14.8		15.5		20.5

TABLE XIII.

TABLE SHOWING NON-FATAL ACCIDENTS DUE TO BEING STRUCK BY AUTOMOBILES CLASSIFIED BY HOURLY GROUPS AND DISTRIBUTED BY DAYS OF THE WEEK.

Hourly groups	Days															
	Total		Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	595	100.0	54	9.1	113	19.0	66	11.1	86	14.4	79	13.3	88	14.8	109	18.3
A.M.																
12 to 3	17	100.0	4	23.4	6	35.3	1	5.9	2	11.8	2	11.8	2	11.8	..	....
3 to 6	10	100.0	1	10.0	4	40.0	1	10.0	3	30.0	..	....	1	10.0	..	....
6 to 9	24	100.0	2	8.3	4	16.7	3	12.5	4	16.7	3	12.5	2	8.3	6	25.0
9 to 12	71	100.0	4	5.6	22	31.0	6	8.4	12	16.9	6	8.5	9	12.7	12	16.9
P.M.																
12 to 3	121	100.0	11	9.1	20	16.5	17	14.0	20	16.5	16	13.2	15	12.4	22	18.3
3 to 6	150	100.0	15	10.0	22	14.7	21	14.0	18	12.0	25	16.7	30	20.0	19	12.6
6 to 9	126	100.0	9	7.2	25	19.8	12	9.5	16	12.7	15	11.9	23	18.3	26	20.6
9 to 12	76	100.0	8	10.4	10	13.2	5	6.6	11	14.5	12	15.8	6	7.9	24	31.6
Number P.M.	473		43		77		55		65		68		74		91	
Per cent. P.M.		100.0		9.1		16.3		11.6		13.7		14.4		15.7		19.2

GRAPH 8.

GRAPH SHOWING THE PER CENT. DISTRIBUTION OF NON-FATAL ACCIDENTS BY P. M. HOURLY GROUPS THROUGHOUT EACH DAY OF THE WEEK.

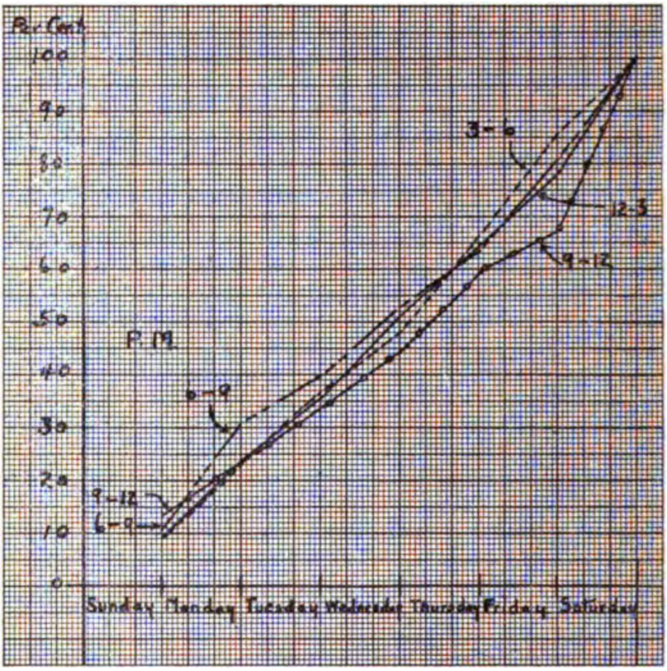


TABLE XIV.

TABLE SHOWING THE NUMBER AND PER CENT. OF PRECINCTS REPORTING FATAL AND NON-FATAL ACCIDENTS FROM SPECIFIC CAUSES* DURING THE FOUR-MONTH PERIOD.

Month	Precincts				
	Total	Fatal Accidents		Non-fatal Accidents	
		No. reporting	Per cent. reporting	No. reporting	Per cent. reporting
Total	136	52	38.2	119	87.5
April, '18	34	11	32.4	30	88.2
July, '18	34	11	32.4	34	100.0
November, '18	34	21	61.8	34	100.0
January, '19	34	9	26.5	21	61.8

* See note to Table V.

Brief attention should be given to the distribution throughout the city of fatal and non-fatal accidents. In each month the per cent. of precincts reporting fatal and non-fatal accidents was as given in Table XIV.

The frequencies of both fatal and non-fatal accidents by precincts during the four months are shown in Tables XV and XVI. The fatal accidents are listed singly and the non-fatal ones in groups of five.

TABLE XV.

TABLE SHOWING BY MONTHS THE FREQUENCY DISTRIBUTION OF PRECINCTS BY NUMBER OF FATAL ACCIDENTS.

Fatal Accidents Frequency	Number and Per cent. of Precincts by Months									
	Total		April, 1918		July, 1918		November, 1918		January, 1919	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total......	52	100.0	11	100.0	11	100.0	21	100.0	9	100.0
1............	41	78.8	8	72.7	9	81.8	16	76.2	8	88.9
2............	8	15.4	2	18.2	2	18.2	3	14.3	1	11.1
3............	1	1.9	..	....	..	....	1	4.7	..	....
4............	2	3.9	1	9.1	..	....	1	4.8	..	....

TABLE XVI.

TABLE SHOWING BY MONTHS THE FREQUENCY DISTRIBUTION OF PRECINCTS BY NUMBER OF NON-FATAL ACCIDENTS.

Frequency groups	Number and Per cent. of Precincts by Months									
	Total		April, 1918		July, 1918		November, 1918		January, 1919	
	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total......	119	100.0	30	100.0	34	100.0	34	100.0	21	100.0
0 to 5.......	19	16.0	6	20.0	7	20.6	3	8.8	3	14.3
5 to 10......	56	47.1	14	46.7	16	47.1	14	41.2	12	57.1
10 to 15......	28	23.5	5	16.7	7	20.6	12	35.3	4	19.0
15 to 20......	10	8.4	2	6.7	3	8.8	4	11.8	1	4.8
20 to 25......	2	1.7	2	6.6	..	....	..	....	..	....
25 and over*..	4	3.3	1	3.3	1	2.9	1	2.9	1	4.8

* 1 at 27; 1 at 36; 1 at 41; 1 at 50.

Precinct 1 is almost identical with "The Loop" district, being bounded on the south by Van Buren street, on the east

TABLE XVII.

TABLE SHOWING THE NUMBER OF NON-FATAL ACCIDENTS OCCURRING IN PRECINCT 1—"THE LOOP"—DURING FOUR MONTHS.

Streets—East and West	Total	Streets—North and South									
		Michigan Avenue	Wabash Avenue	State Street	Plymouth Court	Dearborn Street	Clark Street	LaSalle Street	Wells Street	Franklin Street	Market Street
Total	154	5	27	49	1	17	23	15	8	5	4
Rush St. Bridge	1	1									
Dock	1		1								
South Water	4	1	1	1		1					
Lake	10		3	4		1	1	1			
Randolph	10	2	2	5			1				
Washington	23	1	2	7		2	4	3	1	2	1
Madison	24		3	8		3	6	2	1	1	
Monroe	20		7	3		3	3	3	1		
Adams	21		3	5		3	3	3	1	1	2
Jackson	31		5	14		2	4	2	2	1	1
VanBuren	9			2	1	2	1	1	2		

TABLE XVIII.

TABLE SHOWING THE NUMBER AND PER CENT. DISTRIBUTION OF ALL NON-FATAL ACCIDENTS IN PRECINCT 1—"THE LOOP"—BY HOURLY GROUPS.

Hourly groups	All Causes	
	Number	Per cent.
Total	154	100.0
A. M.		
12 to 3	7	4.6
3 to 6	..	...
6 to 9	8	5.2
9 to 12	21	13.6
P. M.		
12 to 3	45	29.2
3 to 6	44	28.6
6 to 9	17	11.0
9 to 12	12	7.8
Number—P. M.	118	
Per cent.—P. M.		76.6

The reports are not sufficiently explicit to serve as a satisfactory record of the nature of the injury. Undoubtedly minor injuries as reported, not infrequently develop later to be serious. A detailed and individual canvass of each injured person would be necessary to establish the true nature of the injury. This was not possible, however, respecting the accident data herewith presented, so it has seemed advisable to omit entirely any analysis of this phase of the data. From the points of view treated, the data seem to have some interest, and they are presented here because they seem to throw light on certain types of traffic accidents in a modern city.

CLASSIFICATION OF STATISTICAL SERIES.

By Edmund E. Day

Classification of statistical series is more than an exercise in applied logic; it is the beginning of statistical analysis. Statistical methods to be reliable must respect the character of the data in hand. Dependable scientific results rest as much upon knowledge of the conditions under which a given operation is desirable as upon skill in the performance of the operation finally selected. What is admirable practice for one body of material is unpardonable malpractice for another. Recognition of the fundamental differences between statistical series of different types is thus the first step in satisfactory analysis.

Classification is always shaped by the purpose for which classification is undertaken; corresponding to a large variety of purposes, a large number of different classifications may be evolved.* However, in the classification of statistical series, by far the most generally important purpose is the development of statistical method. What is needed is a classification which will materially strengthen and clarify the exposition of statistical theory.

No clear notion of such a classification of series is to be obtained from the standard treatises on statistical theory. Several of the most widely employed texts appear practically to ignore the matter.† Other works recognize by implication the essential differences between historical data and other types of statistical material, but get no further.‡ Professor Horace Secrist, in his recent *Introduction to Statistical Methods* (New York, 1917), divides statistical tables into three classes: (1) "those which express historical data"; (2) "those which describe a situation or condition in cross-section"; (3) "those which express variable data of non-historical character."* But the logical basis of this classification is not indicated, and the distinction between the second and third classes is nowhere made clear.† Only among some of the Continental statisticians has the classification of series been carefully considered.‡ Unfortunately among these writers the full import of classification for the development of statistical theory has not been realized. In general, the classification of statistical series and the exposition of statistical theory have influenced each other but little.

**Cf.*, F. Zizek, *Die Statistischen Mittelwerte* (Leipzig, 1908), ch. 1. Translated under title of "Statistical Averages," by W. M. Persons (New York, 1913).

†*E. g.*, G. U. Yule, *Introduction to the Theory of Statistics* (London, 1912), and C. J. West, *Introduction to Mathematical Statistics* (Columbus, 1918). The treatment of method in both of these texts is almost exclusively from the viewpoint of the frequency, or attributive, distribution.

‡*E. g.*, A. L. Bowley, *Elements of Statistics* (3d ed., London, 1907); W. I. King, *Elements of Statistical Method* (New York, 1914).

A classification, serviceable for the purposes of statistical analysis, must be based upon the relation between statistical series and the original individual observations. It is a common-place of statistical discussion that even the simplest observations involve three elements: (1) a location in time; (2) a location in space; and (3) the existence (or non-existence), possibly the existence in varying degree, of specified characters or attributes. These basic elements are the raw stuff from which statistical series are made. Naturally paralleling the different observational elements are the different types of series. A series may be constructed: (1) of individual observations without significant time or space differences but exhibiting some attribute in varying degree; or (2) of individual observations which are alike except that they are differently located in space; or (3) of individual observations which differ only in their time limits. Thus the three fundamental types of series are: (1) attributive—commonly called frequency—distributions; (2) spatial distributions; (3) temporal distributions.

The value of this classification lies in its illumination of the problems of statistical analysis. The different phases of statistical method are of varying importance for the three types of series. The customary discussion of averages, for example, relates primarily to the attributive distribution. In the case of time series, the relative number is more directly significant than the average. Furthermore, time series are peculiar in that they require a separation of the different varieties of temporal variation: normal, or secular, trend; cyclical fluctuation; seasonal variation. Spatial distributions afford exceptional opportunities for the graphic method, which in the exhibition of geographic relationships possesses advantages over any other mode of analysis. It would be easy to multiply examples of the desirability of recognizing in the explanation of statistical methods the differences between the underlying types of statistical series. The fact that the more refined methods of statistical analysis have been developed in the study of attributive distributions, whereas most economic materials assume the form of time series, is further reason for the classification of series in the extension of statistical method to economic investigation. It is to be hoped that future texts on statistical theory will see the gain to be secured by classification, and will order their exposition of statistical methods with adequate regard for the essential differences between the fundamental types of statistical series.

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*See pp. 142–145.

†Furthermore, against Professor Secrist's attempt, it may fairly be urged that it is less important to classify statistical tables than statistical series, since a single table may contain a variety of series.

‡*Cf.*, G. v. Mayr, *Statistik und Gesellschaftslehre* (2d ed., Tübingen, 1914), Vol. I, pp. 142–149; Al. Kaufmann, *Theorie und Methoden der Statistik* (Tübingen, 1913), pp. 487–488.

PRELIMINARY NOTE ON THE INCIDENCE OF EPIDEMIC INFLUENZA AMONG THE ACTIVELY TUBERCULOUS.*

By Raymond Pearl.

A problem of great interest in connection with the influenza pandemic of 1918 may be stated in this way: Were actively tuberculous persons more or less likely to contract influenza during the epidemic than non-tuberculous members of the general population living under essentially the same environmental conditions, and equally exposed to infection? The question may be argued *a priori* either way, and in the short period since the epidemic a good deal of what can in fairness only be called wholly unscientific and inconclusive has been written about it. It can only be answered by a sufficiently large collection of critically adequate statistics.

The purpose of this note is to present in a preliminary way certain *ad hoc* statistical material collected last spring in this laboratory, and to call the attention of other students of the influenza epidemic to the fact that we have this somewhat unique statistical material and are working it up as fast as opportunity permits. The statistics here presented are not complete. In the final report complete data will be given. The small amount of material yet to be added to the tabulations will not, however, change in any essential particular the significance of the figures here presented.

The data were collected by the Visiting Tuberculosis Nurses of the Baltimore Health Department, working on this problem under the direction and supervision of Miss Blanche F. Pooler, supervisor of field workers in the writer's laboratory. Each household containing an active case of tuberculosis registered with the Health Department was visited by a nurse and a card form filled out by her, after personal determination of the facts about the family. Besides the data included in the present

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* Papers from the Department of Biometry and Vital Statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 8.

TABLE I.

SHOWING THE INCIDENCE OF INFLUENZA AMONG TUBERCULOUS AND NON-TUBERCULOUS WHITE INDIVIDUALS, ARRANGED (A) BY NUMBER OF PERSONS IN HOUSEHOLD, AND (B) BY PRESENCE OR ABSENCE OF OTHER CASES OF INFLUENZA.

Number in household	Tuberculous				Not Tuberculous			
	Influenza		No Influenza		Influenza		No Influenza	
	Other cases in household	No other cases in household	Other cases in household	No other cases in household	Other cases in household	No other cases in household	Other cases in household	No other cases in household
1	..	..	..	14	..	..	..	..
2	4	10	12	108	4	15	7	100
3	46	39	38	161	76	22	118	292
4	72	28	81	255	168	37	243	696
5	89	27	78	221	262	21	363	749
6	73	16	96	210	303	29	419	822
7	71	9	83	123	358	18	480	636
8	51	2	68	82	257	24	414	446
9	22	3	40	33	117	8	188	246
10	18	1	16	20	114	3	138	170
11	8	..	12	12	49	5	91	43
12	3	..	5	5	36	1	63	43
13	2	..	3	2	32	..	28	24
14	..	..	..	..	..	..	..	..
15	1	..	1	1	12	..	16	14
Totals	460	135	533	1,247	1,788	183	2,568	4,281
	595		1,780		1,971		6,849	
	2,375				8,820			

tabulations information was got on a number of other points which will be presented in the definitive report. Each card brought in by a nurse was critically scrutinized by Miss Pooler, and if any information was lacking, or if the facts recorded were in any respect unusual, the nurse was sent back on a second or even third visit, until finally the data accepted as of final record were as nearly accurate as it was humanly possible to make them.

Tables I to III inclusive comprise the preliminary tabulations which it is desired to present here. Only the figures for whites are given in this note. The numbers in the tables for negroes were too small to warrant taking space for in a brief preliminary communication. The negro data show no essential differences from the whites in respect to the main points here under discussion. The tables are arranged on the principle of dichotomy to get a maximum of information in a minimum of space. A description of the second line of Table I will indicate

TABLE II.

SHOWING THE INCIDENCE OF INFLUENZA AMONG WHITE TUBERCULOUS PERSONS ACCORDING TO (A) DURATION OF THE TUBERCULAR PROCESS, AND (B) PRESENCE OR ABSENCE OF OTHER CASES OF INFLUENZA IN THE HOUSEHOLD.

Years patient had been tuberculous	Patient Had Influenza			Patient Did Not Have Influenza		
	Other cases in household	No other cases in household	Total	Other cases in household	No other cases in household	Total
Under 1 year	108	65	173	57	133	190
1 year	44	17	61	68	172	240
2 years	65	15	80	75	176	251
3 "	63	20	83	64	139	203
4 "	50	15	65	65	128	193
5 "	56	11	67	46	135	181
6 "	39	14	53	49	109	158
7 "	40	10	50	36	76	112
8 "	40	11	51	37	74	111
9 "	35	10	45	45	110	155
10 "	13	4	17	11	31	42
11 "	1	2	3	7	17	24
12 "	6	..	6	8	16	24
13 "	1	..	1	2	2	4
14 "	2	..	2	..	3	3
15 "	..	..	..	3	7	10
16 "	1	..	1	3	..	3
17 "	..	..	..	..	1	1
18 "	1	..	1	..	..	..
20 "	..	..	..	2	..	2
23 "	..	..	..	..	1	1
25 "	..	..	..	..	1	1
32 "	..	..	..	..	1	1
34 "	1	..	1	..	..	..
Total	566	194	760	578	1,332	1,910

how this table is to be read. In households of two persons each there were 14 tuberculous persons who had influenza and 120 tuberculous persons who did not have influenza. Of the 14 tuberculous persons who had influenza 4 were in households where other cases of influenza occurred, and 10 were in households where no other cases of influenza except their own occurred. Again, in households of two persons, there were 19 non-tuberculous persons who had influenza and 107 who did not. Four of the influenza cases occurred in households where there were no others and 15 of the cases were in households where there were other cases, etc.

From Table I we note that of the 2,375 tuberculous persons, 595, or 25 per cent., had influenza, while 1,780, or 75 per cent., did not have this disease during the epidemic. Of the 8,820 non-tuberculous individuals living in the same households as the tuberculous, 1,971, or 22.3 per cent., had influenza,

TABLE III.

SHOWING THE INCIDENCE OF INFLUENZA AMONG TUBERCULOUS AND NON-TUBERCULOUS WHITES ACCORDING TO THE NUMBER OF CASES OF INFLUENZA IN THE HOUSEHOLD.

Number of cases of influenza in household	Number of households	Total number of persons in household	Total cases of influenza	Persons Tuberculous			Persons not Tuberculous		
				Had influenza	Did not have influenza	Total	Had influenza	Did not have influenza	Total
0............	1,104	5,492	0	0	1,234	1,234	0	4,258	4,258
1............	324	1,644	324	137	236	373	187	1,084	1,271
2............	228	1,231	456	132	141	273	324	634	958
3............	152	844	456	113	71	184	343	317	660
4............	88	546	352	65	35	100	287	159	446
5............	73	536	365	68	27	95	297	144	441
6............	46	358	276	40	13	53	236	69	305
7............	26	218	182	33	5	38	149	31	180
8............	14	131	112	14	3	17	98	16	114
9............	4	42	36	3	2	5	33	4	37
10............	..	..	..	..	..	..	..	..	..
11............	..	..	..	..	..	..	..	..	..
12............	..	..	..	..	..	..	..	..	..
13............	1	13	13	1	..	1	12	..	12
Total.....	2,060	11,055	2,572	606	1,767	2,373	1,966	6,716	8,682

and 6,849, or 77.7 per cent., did not have it. It, therefore, appears that, under the same environmental conditions of living, only 2.7 per cent. more of the tuberculous individuals than of the non-tuberculous contracted influenza during the epidemic. This difference is small and probably not statistically significant. There are many other interesting points brought out by the data of Table I, discussion of which will be reserved for the complete paper.

Table II concerns the tuberculous *only*. It arranges the data to show the relative liability of a tuberculous person to contract epidemic influenza, in relation to the length of time he (or she) had been tuberculous.

This table shows among other things that the longer had been the duration of the tubercular process the smaller in general was the probability that the patient would have influenza during the epidemic, though in duration of .1 to 9 years inclusive the proportionate incadence of influenza changed but slightly.

From Table III we note:

1. That a little more than one-half (1,104) of the total num-

ber of *households* (2,060) comprised in the statistics had no case of influenza in them during the epidemic.

2. That only about one-fourth (2,572) of the total *persons* (11,055) included in the statistics had influenza.

3. That in households where only one case of influenza occurred, 37 per cent. of the tuberculous persons living in such households had influenza, while but 15 per cent. of the non-tuberculous living in such households had influenza.

4. That in households where two cases of influenza occurred, 48 per cent. of the tuberculous persons, and 34 per cent. of the non-tuberculous living in such households had influenza.

5. That in households where three or more cases of influenza occurred, 68 per cent. of the tuberculous persons and 66 per cent. of the non-tuberculous living in such households contracted influenza.

Discussion of the meaning of the above data, presented here simply as facts, will be undertaken in the later complete report.

MEMBERSHIPS IN THE ASSOCIATION.

New Members, Elected July to November, 1919.

Blanche L. Altman, 542 So. Dearborn St., Chicago, Ill.
Cecil S. Ashdown, 50 Broad St., New York City.
Albert Babbitt, University of Nebraska, Lincoln, Neb.
Roscoe B. Bailey, 111 Devonshire St., Boston, Mass.
Charles E. Baldwin, Bureau of Labor Statistics, Washington, D. C.
Donald R. Belcher, American Tel. and Tel. Co., New York City.
Bradford Boardman, American Tel. and Tel. Co., New York City.
Alice C. Boughton, J. Walter Thompson Co., New York City.
J. Chester Bowen, Bureau of Labor Statistics, Washington, D. C.
W. C. Brenke, University of Nebraska, Lincoln, Neb.
Ernest W. Brown, Yale University, New Haven, Conn.
Margaret A. Burt, 256 Broadway, New York City.
G. E. Buxton, 322 King St., Pottstown, Pa.
Zenas W. Carter, 35 W. 39th St., New York City.
Harry P. Coats, University of Vermont, Burlington, Vt.
Wilson Compton, 11 So. La Salle St., Chicago, Ill.
W. L. Crum, Yale University, New Haven, Conn.
Paul H. Douglas, University of Washington, Seattle, Wash.
Maud B. Foote, Bureau of Vocational Information, New York City.
Edith S. Gray, U. S. Children's Bureau, Chicago, Ill.
Ebenezer C. Griffing, Winchester Repeating Arms Co., New Haven, Conn.
Chas. K. Harris, General Motors Corp., Detroit, Mich.
Ruth S. Hutzel, General Motors Corp., Detroit, Mich.
Philip B. Kennedy, Dept. of Commerce, Washington, D. C.
Frank F. Kolbe, General Motors Corp., New York City.
Lawrence Marcus, 501 West 124th St., New York City.

John A. Miller, Swarthmore College, Swarthmore, Pa.
Louis H. Mueller, State Compensation Ins. Fund, San Francisco, Cal.
Joseph E. Pogue, Sinclair Refining Co., Chicago, Ill.
Albert S. Prescott, 120 Broadway, New York City.
Raymond B. Prescott, General Motors Corp., Detroit, Mich.
Elmer C. A. Swanson, C. E. Erickson & Co., Des Moines, Ia.
Brandreth Symonds, Chief Medical Director, Mutual Life Ins. Co., New York City.
B. F. Young, 5000 Broadway, New York City.
L. D. H. Weld, Swift & Co., Union Stock Yards, Chicago, Ill.

CORPORATE MEMBERSHIPS.

The following corporations have accepted the invitation of the Association to become Corporate Members: The American Telephone & Telegraph Company, 195 Broadway, New York City; The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

At the Annual Meeting in Richmond the Association amended the Constitution so as to provide for a class of corporate members with annual dues of $100.00.

The importance of statistical work during the war and the need revealed for new and more adequate sources of statistical information emphasized the possibilities of the American Statistical Association for the future. The rapid development of new fields of statistical work among business and private organizations showed the enlarged scope for such a Scientific Association's activities.

For increasing the usefulness of our publications and promoting the effectiveness of our Committee organization, in order to make the Association an influence in the development of statistics, more funds are urgently needed. Additional funds devoted to the above purposes will benefit business and other corporate organizations which are making increasing use of statistical methods and establishing large staffs of statistical and research experts. The Association, therefore, feels justified in asking corporations to support the scientific and practical activities which the Association expects to undertake in the future.

Members are urged to make suggestions to the Membership Committee or to the Secretary's Office concerning possible corporate members and how they may be interested in the activities of the Association. These corporations are not limited to business.

The following form letter and statement concerning the Association, to be sent to the proper officials of the corporation, have been approved by the Board of Directors for use in securing corporate members:

Dear Sir:

An invitation is hereby extended to your organization to become a corporate member of the American Statistical Association. You will find enclosed a statement regarding the Association's past record, its present achievement and its future possibilities.

The war proved conclusively the necessity for reliable statistics not only of industry but of every phase of the nation's life. The present industrial era with its foreign trade possibilities creates a constantly increasing demand for reliable data.

Under the broader financial program possible with the support of corporate members, the Association can render a real service to business interests of the country. There would seem to be no real reason why figures regarding the volume of general business, especially manufacturing, should not be compiled as frequently and with as great care as figures now collected with reference to agriculture and mining.

Dues of corporate members are $100 per year. Checks should be made payable to the American Statistical Association and mailed to Professor Robert E. Chaddock, Secretary and Treasurer, American Statistical Association, Kent Hall, Columbia University, New York.

Trusting that the Association may have your valued membership and support, I remain

Yours very truly,

Vice President,
Chairman Membership Committee.

Accompanying the letter is the following statement concerning the Association:

PAST.

The American Statistical Association is one of the oldest scientific associations in America, having been organized in Boston in 1839. At that time there were no professional statisticians. The output of statistics was almost negligible. The present high rank of the State of Massachusetts in statistical work is largely due to the efforts of these pioneers. In national problems the officers and members of the Association have had a most important part, particularly in every kind of public bureau interested in the collection and analysis of statistical data. Members of the Association have directed the work of the Federal censuses for the last fifty years.

PRESENT.

Recent activity of the Association in the broader field of statistics, such as statistics of industry, the internal statistics of corporations, etc., has increased the membership rapidly. A widespread distribution of the 850 members proves the real interest in the science of statistics, for many of these members can never attend a meeting of the Association. The publications of the Association have been issued regularly for thirty years. More good papers are available than it is possible to print with the present income of the Association.

FUTURE.

The members of the Association have given a vast amount of time to advisory work for Federal, State and Municipal bodies. College professors in the field of statistics particularly deserve the thanks of the whole nation for their untiring efforts. It is hoped that the broader scope of the Association on a less restricted financial basis will permit paid secretarial service for the use of the committees and for the improvement of the publications. When men who have devoted their lives to research and teaching are willing to give their time to committee work and editorial work, it would seem that the public and, more particularly, the corporations who benefit from the results of the labor, should bear a share of the expenses actually involved.

The comprehensive census of manufactures taken by the Government every five years is of comparatively little use to business in the United States. Preparation and publication of the elaborate report requires about two years. In their respective fields the Department of Agriculture and the Bureau of Mines have shown what can be done to furnish valuable data promptly. The American Statistical Association hoped to secure legislation by which the United States Census office may collect and analyze data regarding the continually increasing output of manufacturing plants of the United States. It would not be difficult to secure for key industries figures giving the number of units of output. Totals expressed in units of quantity would be more significant and probably more reliable than figures expressing values only. The matter has been actively taken up with the officials of the Department of Commerce and of the Bureau of the Census. All those thus far approached have expressed themselves as generally in favor of the plan. It rests with the business men of the United States to act together to secure the necessary legislation.

The executive officers of the Chamber of Commerce of the United States of America have been authorized by vote of the Executive Board to present this matter to the Bureau of the Census. It is expected that other influential organizations will also take an active part in this campaign.

NOMINATIONS FOR OFFICERS OF THE ASSOCIATION, 1919–1920.

Your Committee on Nominations submits herewith nominations for officers of the Association for the year 1919–1920 as follows:

President
    George E. Roberts
Vice-Presidents
    Carroll W. Doten
    Horace Secrist
    Louis Meriam
Counsellors
    Joseph A. Hill
    Walter F. Willcox
    Warren M. Persons
Secretary-Treasurer
    Robert E. Chaddock
Librarian
    Horace L. Wheeler
Editor
    William F. Ogburn

Wesley C. Mitchell, *Chairman*
E. M. Goldenweiser
W. S. Rossiter
Committee on Nominations

AN APPEAL.

During the night of November 27 fire completely destroyed McCoy Hall, formerly the Administration Building of Johns Hopkins University, and immediately occupied by the Federated Charity Organization of the City of Baltimore, and certain departments of the School of Hygiene and Public Health of Johns Hopkins University. About three weeks ago the writer moved his department, that of Biometry and Vital Statistics in the School of Hygiene, into McCoy Hall, occupying the whole of the second floor of that building. On Thanksgiving Eve the writer had completed the removal to this building of all of his private scientific library comprising roughly some fifteen thousand reprints and pamphlets. In the fields of biometry and genetics this library was in some respects unique owing to the fact that the writer began his activities in the field of biometry nearly twenty years ago when that branch of biological science was just getting under way, and consequently there was a completeness to the collection in that field which makes its total loss a catastrophe of overwhelming significance to the writer's scientific work.

In addition, all the accumulated unpublished records of the writer's work for the past twenty years were completely destroyed. This included the records of his work in the genetics of poultry for ten years at the Maine Agricultural Experiment Station.

This second loss is, of course, wholly irremediable. The purpose of this note is to appeal to workers in the fields of genetics, biometry, and vital statistics, to help in remedying the first loss insofar as it can be remedied by sending to the writer duplicates of such of their reprints as they may have available and which they were kind enough to send him before. Any help in this direction will be deeply appreciated.

Raymond Pearl.

REVIEWS AND NOTES.

Statistical Methods Applied to Education: A Textbook for Students of Education in the Quantitative Study of School Problems. By Harold O. Rugg, Assistant Professor of Education, University of Chicago. Pp. xviii+410. Boston, Houghton, Mifflin Co. $2.

The use of statistical methods is extending in all directions, even into the arts that are supposed by their votaries to depend in some unknown way upon inspiration or "personality," or a state of grace, or some other mysterious force—such as education and salesmanship. For some fifteen or twenty years people engaged in the teaching business have witnessed the conflict between the old and the new, taking at certain points the form of a struggle between mysticism and exact knowledge. The latter is gaining strength.

There are, indeed, many factors in effective educational procedure that we are quite unable to measure. Nevertheless the scientifically inclined educators insist that we measure whatever can be measured, as accurately as possible. And the result is the development of educational statistics. This book represents the attempt to teach statistical method to men and women who are preparing themselves for the work of teaching, on precisely the same basis as we have in the past taught higher mathematics to students of engineering. Quantitative method is a necessary instrument for progressive and creative work in both fields.

Dr. Rugg realizes the difficulties in the way of introducing teachers to this subject. Most teachers have had little mathematical study beyond high school algebra—and that algebra of a kind that is not usable even for those who "did well" with it as students. The technical text-book on statistics is, therefore, out of the question. To teach empirical rules and formulae would be comparatively easy; but in the long run not worth while. The author chooses the more difficult task of grounding his students thoroughly in the principles and methods of statistics, avoiding so far as possible technical mathematical language in his explanations.

In accordance with the pedagogical doctrine "learn to do by doing," he has the students work out exercises that are selected altogether from the field of school management or education in general. Indeed, the student who gets all of his knowledge of statistics from this book might end up with the distinct feeling that in some way educational statistics is something *sui generis*, having no connection with other kinds of statistics. This appears from the frequency with which the adjective *educational* occurs throughout the book as qualifying "statistics." The fact is that this makes an excellent introduction to the study of statistics for people who will be through with their "education" when they quit their schooling, and who will want to apply their statistics in other fields, notwithstanding the limitations in the choice of exercises and illustrative material.

Although the author does not assume a knowledge of higher mathematics on the part of his students, he does assume a high degree of mental stamina. In spite of the logical and systematic development of the theme, there are many passages that are unnecessarily involved and obscure, calling for careful rereading even from some who are familiar with the subject matter. There are also occasional slips that will cause trouble to the beginner—five cents for five per cent.; symmetrical distribution for asymmetrical distribution (page 118); "total number of deviations" for "total quantity (or amount) of deviation" (page 167).

The first chapter discusses the uses of statistical methods, and classifies the types of educational problems that lend themselves to quantitative treatment. This is followed by a study of the various methods commonly employed for the collection of data. There are here some excellent analyses of principles to be followed in drawing up question blanks, and in making use of the returns. The tabulation of the gathered data ("educational" data) and the classification of such data for statistical purposes are next described, with an incidental discussion of the value of mechanical devices in such work.

Under the "Method of Averages," are presented the principles of mode, median, mean (arithmetical, harmonic and geometric), short methods for computing, their distinctive features and special uses. In subsequent chapters are discussed in order the measurement of variability by the range, the quartile, mean deviation, standard deviation, relative variabilities and skewness; the frequency curve and the normal distribution curve; the use of the normal curve in education; correlations; and the use of graphic methods and tables, with illustrations selected from some of the most effective recent reports of studies and surveys.

There is an inserted chart carrying a tabular survey of published quantitative studies of educational administration. The Appendices contain a classified bibliography of quantitative studies in education and school administration, another one on statistical methods, a summary of mathematical formulae, and ten tables of constants and coefficients to assist in computation. Throughout the text there are excellently formulated definitions, summaries and enumerations of the steps to be taken in every type of statistical procedure and computation. There are 80 diagrams and 68 tables; all of these are closely analyzed in the text and furnish excellent illumination for the student. And finally, there is a reasonably complete index.

Perhaps no single factor will contribute so much to the stiffening of educational procedure as well as of educational administration in the years ahead of us as the general acceptance by teachers of quantitative standards in place of the well intentioned sentiments and pious wishes that characterized so much of this branch of public service during the past generation. And to this end Professor Rugg's book will prove a valuable aid.

BENJ. C. GRUENBERG.

New York City

MUNICIPAL STATISTICS AND THE SOCIAL UNIT ORGANIZATION.

THE SOCIAL UNIT PLAN.

The Social Unit is an experiment in democratic organization through which the entire citizenship can participate directly in the control of community affairs, while making constant use of the highest technical skill available. This plan has been in operation in the Mohawk-Brighton district of Cincinnati since the beginning of 1918, in an area of thirty-one blocks, with a total population of about 12,000. Each block is represented by a block council elected by the people of the block, every person over eighteen years of age being eligible to vote. Each block council elects in turn one representative for the block on the central citizens council, composed of the representatives of the thirty-one blocks. The skilled groups rendering service to the neighborhood,—physicians, nurses, social workers, recreational workers, teachers, etc.—are also organized, each electing a representative to a central occupational council which becomes a planning body to furnish the skill in formulating neighborhood programs. It is a fundamental belief in this scheme that social effort should be aimed not at doing things to and for people without their consent but at stimulating people to meet their own needs in the most effective way possible.

A National Advisory Committee of Statisticians was organized early in the experiment to act as a consulting group in developing the statistical aspects of the experiment. The following are members of that committee: Mrs. Robert M. Woodbury, Charles V. Chapin, Frederick S. Crum, Louis I. Dublin, Irving Fisher, Joseph A. Hill, Wesley C. Mitchell, William F. Ogburn, I. M. Rubinow, Frank H. Streightoff, Robert E. Chaddock, chairman.

PRESENT DEFECTS OF MUNICIPAL VITAL STATISTICS.

City health departments do not generally connect research with administration. For intelligent understanding of health problems and adequate testing of the results of health policies, mortality and morbidity facts must be related to other social and economic phenomena, such as nationality, housing, occupation, sanitary conditions and income. Many of these facts health departments do not have. Health progress needs to be measured and relative health values need to be established by unbiased and continuous analysis of the facts.

Further, our cities are not properly districted for the administration of health and other welfare activities and for the record and analysis of the facts. Smaller and more homogeneous sanitary areas are required. For the guidance of health officials mortality or morbidity rates by boroughs or wards or other political division are not satisfactory because the various factors are hopelessly mingled. Neither the good nor bad conditions are accurately measured.

THE SOCIAL UNIT ORGANIZATION FROM THE VIEWPOINT OF MUNICIPAL STATISTICS.

(1) The Social Unit block organization, because of its close contact with a small number of families, makes possible rapid and accurate record of desired information. This information can be checked and kept up to date. A continuous and approximately accurate picture of community conditions is thus rendered possible.

(2) This form of organization promotes the establishment of specific services to meet neighborhood needs. Nursing service for babies under two years makes the prompt and complete registration of births a matter of neighborhood concern. Medical examination of school children and adults furnishes records as a basis for the improvement of community health. The taking of a census of population facts is regarded as laying the foundation for more intelligent social activities within that district.

(3) The districts organized in this manner are necessarily limited in extent, and of a more homogeneous character than is usually employed in the analysis of statistical data. This promotes a more effective use of data on health, recreation, working and living condition, and standards of living. Municipal statistics should be made the means to the improvement of community life.

(4) A single Social Unit area such as the Mohawk-Brighton district in Cincinnati is too small for accurate statistical analysis of much of the data. If this form of organization is extended to other like units of population this limitation disappears, and a central statistical organization can be established to carry on the work of analysis and research for all the units.

THE STATISTICAL ORGANIZATION OF THE SOCIAL UNIT FROM THE NATIONAL VIEWPOINT.

(1) The Cincinnati Mohawk-Brighton organization is experimental. It is to be regarded as a demonstration laboratory. Whatever is successful in the demonstration in Cincinnati may well be adapted to the needs of other cities. Standard methods for the collection and analysis of community statistics are very necessary before easy and valid comparisons can be made.

(2) Statistics should aid in doing for social work and community welfare what the laboratory methods and tests have done for the natural sciences. The Cincinnati demonstration has a contribution to make in this direction to the entire field of municipal statistics.

(3) The National Statistical Committee of advisors may well become a research group, affiliated with other like groups in the various fields of social effort. Their business would be to study the statistical aspects of community organization everywhere and relate them to the Social Unit experiment. The conclusions of this Committee would be made available to the cities of the entire country.

ROBERT E. CHADDOCK.

Columbia University.

Review of The Second Annual Report on the Statistics of Wisconsin Municipal Finances. Compiled by Statistician A. J. Altmeyer for the Wisconsin Tax Commission, Madison, Wis. 1918. 124 pp.

It is the exception when the report of a state commission is of sufficient general interest to warrant its perusal by persons outside of the state in question. The document here described, however, is so much superior to the typical financial report of a state department that administrative officials and students of finance everywhere may find it well worth their while to glance through its pages and thus obtain suggestions as to possible future improvements in the financial statements of their own states or localities.

The name of the report, "Statistics of Municipal Finances," suggests at once statistics devoted to city budgets. However, the word "municipal" is here used in its broadest sense, and hence the report covers the receipts and expenditures of the state, the counties, the villages, and the "towns" as well as those of the cities themselves.

On page 14 of the report, we read: "It is believed . . . that good accounting and good government go hand in hand and are interdependent." With this point of view the present reviewer is heartily in accord. As government expenditures keep growing apace and absorbing a constantly increasing proportion of the income of the citizens, it behooves the average man to keep a closer and closer watch upon the way in which his money is being used by his agents—the legislators and the administrators of the government. Yet governmental financial reports are too commonly issued in such form that they indicate nothing intelligible to the ordinary citizen. It means little indeed to him to be told that the state government spent a certain number of millions last year. The information must go further and show item by item the principal purposes for which the money was paid. Even in cases in which this is nominally done, the true meaning is often entirely obscured by the fact that expenses are not borne directly, but that the route that the dollar travels from the pocket of the taxpayer to the ultimate recipient is a very devious one. Most probably, several independent bodies have levied the taxes, and the money thus collected has then passed from fund to fund in a fashion so bewildering that none but the expert can trace out the actual relationships existing between those who pay and those who receive. This obscure system of records enables politicians to foist upon the public various wasteful and extravagant schemes and then to convince the same public that these schemes really impose no new burdens upon the taxpayers—all the expense being borne by some fund the origin of which is purposely kept in obscurity.

Furthermore, expenditures, when recorded in gross amounts, make practically no impression upon the mind of the average man. He is interested mainly in comparisons. He probably wishes to know how expenditures under present circumstances compare with those under pre-war conditions; or perhaps, whether the outlay in his home town is larger or smaller than that in the neighboring rival city. Furthermore, figures, in themselves, do not convey much meaning to his mind and it therefore is necessary to convert them into graphic form before our average voter really comprehends their significance.

It is with these truths in mind that Mr. Altmeyer has compiled the "Statistics of Municipal Finances," and he has succeeded well in the difficult task of setting forth many of the most fundamental facts in a way which the really interested citizen cannot fail to understand. The first and most difficult step in that direction has been the elimination from the record of the duplications arising from payments from one fund into another. The figures as presented show directly the net amounts of money which have been spent to support education, highways and bridges, charities and corrections, health, general government, etc. Furthermore, each of these items is compared with similar expenditures for an earlier year and the results are presented in graphic form, so that the citizen can see clearly which departments are mainly responsible for the increasing outlays. The report goes further and shows for the various cities of the state the corresponding expenditures for similar items, and then proceeds to reduce these expenditures to a per capita basis, so that the citizen in any place can accurately compare the outlays made by his own city with the corresponding outlays of neighboring municipalities. The receipts of the state and local governments are analyzed in similarly clear and simple manner. One can see at a glance the part played by local taxes and the share of state subsidies, special assessments, license fees, etc., in furnishing the revenues used by the city governments.

The whole report is characterized by simple statistics and lucid graphs portraying the most important statistical facts concerning Wisconsin finances. It constitutes, therefore, a handbook convenient not only for legislators and officials but also especially useful to every intelligent citizen and taxpayer of the state. A similar presentation for every other state and community in the nation seems to be the first preliminary to eliminating extravagance, waste and graft from our state and local governments. The whole report well illustrates one manner in which properly handled statistics may render great service to the cause of efficient government.

WILLFORD I. KING.

Spartanburg, S. C., Nov. 8, 1919.

Fifty Years of Canadian Progress, 1867 to 1917. By Ernest H. Godfrey, F. S. S. Reprinted from The Canada Year Book, 1918. 50 pp.

The author of this report is well known to readers of this QUARTERLY as the author of the Canadian section of the History of Statistics, published to commemorate the 75th anniversary of the founding of the American Statistical Association. Mr. Godfrey is editor of the Dominion Bureau of Statistics, and this report is a reprint from The Canada Year Book of 1918. Its purpose is, in the author's words, "to pass under statistical review the progress achieved by Canada during the 50 years of its existence as a federal Union."

The scope of the report is indicated by the following list of titles: Area and political boundaries; population and immigration; agriculture; live stock; dairying; forest products; fisheries; minerals; manufactures; trade, transportation, and communication; financial and social statistics. Some of these subjects have been dealt with much more thoroughly than others, and greater attention has been given to facts regarding the physical resources and products of the country than to data concerning the social condition and environment of the Canadian people. Thus, while a large part of the report is devoted to statistics on agriculture, dairying, forestry, fisheries, and mining, the discussion of public finance, immigration, literacy, and education is relatively brief, and no information whatever is given as to racial composition of population, size of families, incomes, racial characteristics of immigrants, or vital statistics. Considered as a record of national progress, the report appears, in a word, strong on the economic and weak on the social and demographic side.

The emphasis upon economic facts is apparently due, in part, to election on the part of the author and, in part, to the lack of suitable statistical material. We find, on referring to the author's chapter in the History of Statistics, already mentioned, that the basic records for educational and vital statistics are in the hands of the provincial, as distinguished from the Dominion, authorities, and it seems clear that the author has relied exclusively on official Dominion statistics. Granting that the facts assembled by the different provincial governments are not readily comparable, the question arises, in view of the importance to the national life of the conditions reflected in vital and educational statistics, whether an attempt should not have been made to piece together figures which would have served to indicate fundamental tendencies.

In manner and method of presentation, the report is excellent. The text is clear and effective, and the table forms adequately meet the requirements of tabular presentation. In the table on pages 32 and 33, several arithmetical errors have been noted—doubtless due to faulty type setting. Thus, the value of smelts caught and landed in connection with sea fisheries is given as $2,107,555, while a subsequent column gives $1,027,555 as the total value of smelts caught and landed. The four maps illustrating territorial growth are good in principle and in general design, but their execution is hardly satisfactory. Graphical representations of some of the more significant facts would have contributed to the effectiveness of the report, without adding appreciably to its volume.

The report affords inspiring reading. Coming to notice at the end of four years of the waste and havoc of war, it is more than ordinarily welcome. The report sets forth in definite, quantitative terms, the unexhausted resources and rapid development of one of the world's youngest and most vigorous countries; in almost every department of national life the record is seen to have been one of uninterrupted growth. Perhaps the highest praise that can be given to the author's statistical workmanship is to say that it is worthy of his theme.

EARLE CLARK.

Ferrocarriles Argentinos. By Alejandro E. Bunge. Buenos Aires, 1918. Pp. 445.

Professor Bunge, of the University of Buenos Aires, is also director general of statistics in the government of Argentina. This volume from his pen is a contribution not only to the study of railways, but also of national wealth, production and consumption, trade, and other general economic subjects. The volume abounds in statistics both for Argentina and for foreign countries, and is well supplied with charts and diagrams.

Chapter I presents statistics of the national wealth of Argentina from 1908 to 1916. The total increased from $23,128 million* in 1908 to $32,556 millions in 1916, a growth of $9,428 millions in eight years, or 41 per cent. The details for 1916 follow:

	Millions
Land	$18,497
Furnishings, clothes, objects of art, etc.	1,700
Cattle	3,203
Agricultural products	1,250
Industrial products	1,650
Agricultural machinery	305
Industrial machinery	440
Metals	796
Railways (35,432 Km)	3,375
Tramways, telephones, telegraphs, electrical and gas plants	680
Ports, canals, and ships	660
Total*	$32,556

An appendix gives statistics of national wealth for Germany, the United States, France, United Kingdom, and various estimates for foreign countries and for Argentina itself.

Chapter II is devoted to railway legislation in Argentina, historically considered. Chapter III treats of railway capital. The final section (page 117) gives the ratio of railway capital to national wealth in various countries as follows:

	Per cent.
Argentina	10.0
Germany	5.1
France	7.7
United States	14.8
United Kingdom	8.8
Italy	8.6

The figures for France and Italy are based on private wealth only.

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*These figures of national wealth are all in terms of $m/n (moneta nacional), equivalent normally to about 42.45 cents in American money.

Publications of the American Statistical Association.

The New Series of the Association, issued quarterly, will be sent to members of the Association on payment of the annual dues of three dollars. The subscription price is three dollars per annum. Separate copies can also be purchased upon remittance of the advertised prices.

The following list of titles includes only the most important papers published in the several issues. There is in addition a considerable amount of miscellaneous material.

VOL. I. 1888–1889. Nos. 1–8. Pp. 492. PRICE $6.00.

No. 1. Statistics of Water Power Employed in Manufacturing in the United States. George F. Swain. 75 cents.

Nos. 2, 3. Park Areas and Open-Air Spaces in American Cities. E. R. L. Gould.
Key to the Publications of the United States Census, 1790–1887; with Occasional References to Other Statistical Works. Edward Clark Lunt. $1.00.

No. 4. Life Insurance in the United States. Walter C. Wright. $1.00.

No. 5. Notes on the Statistical Determination of the Causes of Poverty. Amos G. Warner. Remarks. Samuel W. Dike.
Statistics of Divorce in the United States and Europe. Samuel W. Dike. 50 cents.

No. 6. American Railroad Statistics. Arthur T. Hadley.
Statistics of Municipal Finance. Henry B. Gardner. 75 cents.

No. 7. Prison Statistics of the United States for 1888. Roland P. Falkner. 50 cents.

No. 8. Finance Statistics of the American Commonwealths. Edwin R. A. Seligman.
Divorce in France. Benjamin F. Keller.
Relief of the Poor in Germany. A. G. Warner. $1.00.

VOL. II. 1890–1891. Nos. 9–16. Pp. 470. PRICE $6.00.

No. 9. Mortgage Statistics. George K. Holmes. 50 cents.

No. 10. The Study of Statistics in Italian Universities. Carroll D. Wright.
Statistics of Private Corporations. Roland P. Falkner. 50 cents.

Nos. 11, 12. Statistics of the Colored Race in the United States. Francis A. Walker.
How to Make Statistics Popular. Charles F. Pidgin.
Retail Prices in Boston and Vicinity. Walter F. Cook. $1.00.

No. 13. The Growth of Cities in Massachusetts. Horace G. Wadlin.
Rate of Natural Increase of Population in United States. Herman Hollerith.
The First Census of Massachusetts. Samuel A. Green.
The Commercial Death Rate. Albert C. Stevens. $1.00.

No. 14. A Basis for Statistics of Cost of Production. Carroll D. Wright.
A Formula for Predicting the Population of the United States. H. S. Pritchett.
Weight and Longevity. T. B. Macaulay.
Some Results of Sanitary Legislation in England since 1875. Gary N. Calkins. 75 cents.

No. 15. The Eleventh Census. R. P. PORTER.
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